

**CONNEXIONS**

# **MATHEMATICS**

**VIII**



# Mathematics Grade 8

**By:**

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# Chapter 1

## Term 1

### 1.1 Different kinds of numbers<sup>1</sup>

#### 1.1.1 MATHEMATICS

#### 1.1.2 Grade 8

#### 1.1.3 THE NUMBER SYSTEM

#### 1.1.4 (Natural and whole numbers)

#### 1.1.5 Module 1

#### 1.1.6 DIFFERENT KINDS OF NUMBERS

##### CLASS ASSIGNMENT1

- Discover the number system step by step....

##### 1. General: Different kinds of numbers

Provide an example of each of the following numbers:

- Natural numbers  $N = \{\dots\dots\dots\}$
- Counting numbers  $N_0 = \{\dots\dots\dots\}$
- Integers  $Z_+ = \{\dots\dots\dots\}$
- $Z_- = \{\dots\dots\dots\}$
- Rational numbers  $Q = \{\dots\dots\dots\}$
- Irrational numbers  $Q' = \{\dots\dots\dots\}$
- Real numbers  $R = \{\dots\dots\dots\}$

##### 2. Natural numbers

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<sup>1</sup>This content is available online at <<http://cnx.org/content/m31086/1.1/>>.

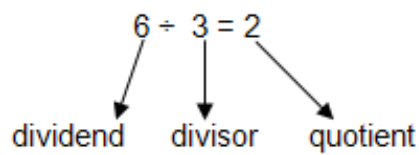
Prime numbers = {.....}	Compound numbers = {.....}
Definition: .....	Definition: .....

**Table 1.1**

Prime numbers + Compound numbers = Natural numbers

3. Divisibility rules

Do you recall that

**Figure 1.1**


---

In each instance, select a number that is divisible by the given divisor and try to deduce a rule for each instance.

	Number	Divisor	Divisibility rule
3.1		2	
3.2		3	
3.3		4	
3.4		5	
3.5		6	
3.6		8	
3.7		9	
3.8		10	
3.9		11	

**Table 1.2**

4. Determine by which numbers (1.3.1 - 1.3.9) 61 226 is divisible and provide a reason for each.

5. Explain what you understand the following terms to mean:

5.1 Multiple:

5.2 Factor:

5.3 Prime number:

5.4 Prime factor:

5.5 Even numbers and odd numbers:

6. Determine the factors of 48.
7. Write out all the multiples of 6 between 23 and 56.
8. Determine the prime numbers between 17 and 78.
9. Determine all odd compound numbers between 16 and 50.
10. Write down all the factors of 50 that are prime numbers.
11. Write down all the factors of 50 that are compound numbers.
12. Explain: Cube numbers. Write down the first 6 cube numbers.
13. Explain: Square numbers. Write down the first 10 square numbers.

1. Write the definition for each of the following:

- ### 1.1 Rational number:

- ### 1.2 Prime number:

- ### 1.3 Compound numbers:

- ### 1.4 Prime factors:

2. Select from  $\{0; 1; 2; 3; 4; \dots ; 36\}$  and write down:

- ## 2.1 The first two compound numbers

- ## 2.2 Odd numbers that are not prime numbers

- ### 2.3 Multiples of 6

- ## 2.4 Factors of 12

- ## 2.5 Prime factors of 12

- ## 2.6 Factors of 36

3. Which of the following numbers  $-\frac{9}{3}$ ;  $\frac{7}{0}$ ; 0; 3; -9; 16;  $2\frac{1}{3}$  are:

- ### 3.1 Integers?

- ### 3.2 Rational numbers?

- ### 3.3 Non-real numbers?

4. Tabulate the following:

- 4.1 Natural numbers
- $< 5$
- .....

- 4.2 Prime numbers
- $< 10$
- .....

- 4.3 The first four multiples of 12 .....

- 4.4 The first four square numbers .....

## Learning unit 1 Assessment 1.1

Assessment of my- self:		by myself:				Assessment by Teacher:								
I can...		[U+F04A]	[U+F04B]	[U+F04C]		1	2	3	4		Critical Out- comes	2	3	4
continued on next page														

[illegible]





I am very satisfied with the standard of my work.			<		Date:			
I am satisfied with the steady progress I have made.					Out of:			
I have worked hard, but my achievement is not satisfactory.					Learner:			
I did not give my best.			>					

Table 1.4

Comments by parents:		Comments by teacher:
Signature: Date:		Signature: Date:

Table 1.5

### 1.1.7 Assessment

Learning outcomes(LOs)
LO 1
Numbers, Operations and RelationshipsThe learner will be able to recognise, describe and represent numbers and their relationships, and to count, estimate, calculate and check with competence and confidence in solving problems.
Assessment standards(ASs)
<i>We know this when the learner :</i>
1.1 describes and illustrates the historical and cultural development of numbers;
1.2 recognises, classifies and represents the following numbers in order to describe and compare them:1.2.3 numbers written in exponent form; including squares and cubes of natural numbers and their square roots and cube roots;1.2.6 multiples and factors;1.2.7 irrational numbers in the context of measurement (e.g. square and cube roots on non-perfect squares and cubes);

**Table 1.6**

### 1.1.8 MemorandumACTIVITY 1

2.  $\{2, 3, 5, 7, \dots\}$

Two factors: 1 and itself

$\{4, 6, 8, 9, \dots\}$

More than 2 factors

- Own choice: Ends on even numbers
- Sum of all the numbers  $\div 3$
- Last numbers  $\div 4$ : e.g.  $84 \div 4 = 21$
- Ends on 0 / 5
- Divisible by 2 and 3
- Last 3 numbers  $\div 8$ : e.g.  $3\,720 \div 8 = 90$
- Add all the numbers  $\div 9$
- Ends on 0
- e.g.  $2\,682 + 8 = 10$ ,  $10 - 10 = 0$

$0 \div 11 = 0$ ,  $4 + 6 = 10$

4. 2; 3; 4; 5; 6; 7; 8; 9; 10; 11

$\sqrt{\times \times \times \times \times \times \times \times \sqrt{\phantom{x}}}$

- Count on, e.g. in 3's: Number  $\div 3$
- Number that can divide into another number
- Number with 2 factors: 1 and itself
- Prime number that can divide into another number
- Even: (Ends on even numbers) [divisible by 2]

Uneven: (Not divisible by 2)

6.  $F48 = \{1, 2, 3, 4, 6, 8, 12, 16, 24, 48\}$

7. {24, 30, 36, 42, 48, 54}
8. {19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73}
9. {21, 25, 27, 33, 35, 39, 45, 49}
10. {2, 5}
11. {10, 25, 50}
12.  $x^3$  (number)<sup>3</sup>: 1, 8, 27, 64, 125, 216
13.  $x^2$  (number)<sup>2</sup>: 1, 4, 9, 16, 25, 36, 49, 64, 81, 100

### 1.1.8.1 HOMEWORK ASSIGNMENT 1

1.1: ,  $b \neq 0$  (Decimal: recurring or ends)

- :Number with factors: 1 and itself
- :Number with more than two factors
- :Prime number that can divide onto a number

- :4, 6
- :1, 9, 15, 21, 25, 27, 33, 35
- :6, 12, 18, 24, 30, 36
- :1, 2, 3, 4, 6, 12
- :2, 3
- :1, 2, 3, 4, 6, 9, 12, 18, 36

- :-, 0, 3, -9, 16
- :-, 0, 3 -9, 16, 2
- :

- :1, 2, 3, 4
- :2, 3, 5, 7
- :12, 24, 36, 48
- :1, 4, 9, 16

## 1.2 Prime factors, square roots and cube roots<sup>2</sup>

### 1.2.1 MATHEMATICS

#### 1.2.2 Grade 8

### 1.2.3 THE NUMBER SYSTEM

#### 1.2.4 Module 2

### 1.2.5 PRIME FACTORS, SQUARE ROOTS AND CUBE ROOTS

#### CLASS ASSIGNMENT 1

##### 1. Prime factors

- How do you write a number as the product of its prime factors?
- And how do you write it in exponent notation?

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<sup>2</sup>This content is available online at <<http://cnx.org/content/m31099/1.1/>>.

E.g. Question: Write 24 as the product of its prime factors(remember that prime factors are used as divisors only)

2	24
2	12
2	6
3	3
	1

Table 1.7

Prime factors of  $24 = \{2; 3\}$

24 as product of its prime factors:  $24 = 2 \times 2 \times 2 \times 3$

$24 = 2^3 \times 3$  (exponential notation)

- Now express each of the following as the product of their prime factors(exponential notation) and also write the prime factors of each.

48

48 =

$P_{48} = \{ \quad \}$

60

60 =

$P_{60} = \{ \quad \}$

450

450 = □

$P_{450} = \{ \quad \}$

Figure 1.2

## 2. Square roots and cube roots

- How do you determine the square root ( $\sqrt{\quad}$ ) or cube root ( $\sqrt[3]{\quad}$ ) of a number with the help of prime factors?
- Do you recall this?

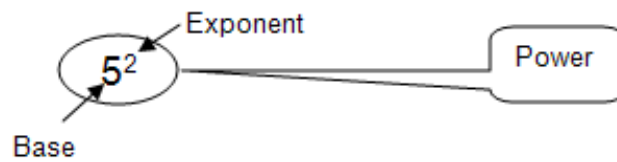


Figure 1.3

- Determine:  $\sqrt{324}$  Step 1: break down into prime factors Step 2: write as product of prime factors (in exponential notation) Step 3:  $\sqrt{324}$  means  $(324)^{\frac{1}{2}}$  (obtain half of each exponent)

2	324	
2	162	
3	81	
3	27	
3	9	
3	3	
	1	

Table 1.8

Therefore:  $\sqrt{324} = (2^2 \times 3^4)^{\frac{1}{2}} = 2^1 \times 3^2 = 2 \times 9 = 18$   
(324 is a perfect square, because  $18 \times 18 = 324$ )

- Remember:  $\sqrt{\quad}$  means  $(\dots)^{\frac{1}{2}}$  and  $\sqrt[3]{\quad}$  means  $(\dots)^{\frac{1}{3}}$

$$\sqrt[3]{8x^{12}} = 2x^{12 \div 3 = 4} \text{ therefore } 2x^4$$

2.1 Calculate with the help of prime factors:

(i)  $\sqrt{1\ 024}$

[illegible]

Table 1.9

(ii)  $\sqrt[3]{1000}$

	1000

Table 1.10

2.2 Calculate:

a)  $(2 \times 3)^2 =$

b)  $3 \times 8^2 =$

c)  $\sqrt[3]{1} =$

d)  $\sqrt{1} =$

e)  $(\sqrt{2})^2 =$

f) then  $(\sqrt{17})^2 =$

g)  $(3 + 4)^3 + 14 =$

h)  $\sqrt{36} + \sqrt{9} =$

i)  $\sqrt{36 + 64} =$

j)  $\sqrt[3]{27} + \sqrt[3]{1} =$

k)  $(\sqrt[3]{27})^3 =$

l)  $\sqrt{64x^{12}} =$

HOMEWORK ASSIGNMENT 1

1. Determine the answers with the help of prime factors:

1.1  $\sqrt[3]{4096}$  1.2  $\sqrt[4]{1296}$





*Step 3:* Now determine the LCM. First write down the BCD and then find the number that occurs in two of the numbers and write it down, finally writing what is left over)

$$\text{LCM} = 4 \times 2 \times 3 \times 5 = 120$$

3. Do the same and determine the BCD and LCM of the following:

38; 57; 95

Calculate it here:

38 = .....

57 = .....

95 = .....

BCD = ..... and LCM = .....

**Assessment**

Assessment of myself:	by myself:		Assessment by Teacher:									
I can...	[U+F04A]	[U+F04B]	[U+F04C]	1	2	3	4		Critical Out-comes	2	3	4
determine prime factors of a number; (Lo 1.2.6)									Critical and creative thinking			
express a number as the product of its prime factors; (Lo 1.2.6; 1.2.3)									Collaborating			
express prime factors in exponential notation; (Lo 1.2.7)									Organising			

*continued on next page*



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Table 1.12

[U+F04A] *good* [U+F04B] *average* [U+F04C] *not so good*

Comments by the learner:			My plan of action:			My marks:		
I am very satisfied with the standard of my work.			<		<i>Date:</i>			
I am satisfied with the steady progress I have made.					Out of:			
I have worked hard, but my achieve- ment is not sat- isfactory.					<b>Learner:</b>			
I did not give my best.			>					

Table 1.13

Comments by parents:		Comments by teacher:
Signature: <i>Date:</i>		Signature: <i>Date:</i>

Table 1.14

Tutorial 1: (Number Systems)  
Total: 30  
1. Simplify:

- 1.1  $\sqrt{100 - 36}$  [1]
- 1.2  $\sqrt{\frac{25}{49}}$  [1]
- 1.3  $\sqrt{2^6 3^{15}}$  [2]
- 1.4  $\sqrt{9}(\sqrt{9} + \sqrt{16})$  [3]
- 1.5  $9^2$  [1]
- 1.6  $\sqrt{a} = 4, a =$  [1]
- 1.7  $\sqrt[3]{a} = 5, a =$  [1] **[10]**
2. Use the 324, and answer the following questions:
  - 2.1 Is 324 divisible by 3? Give a reason for your answer. [2]
  - 2.2 Write 324 as the product of its prime factors [3]

[illegible]

Table 1.15

- 2.3 Now determine  $\sqrt{324}$  [2]
- 2.4 Is 324 a perfect square? Give a reason for your answer. [2] **[9]**
3. Determine each of the following without using your calculator.
  - 3.1  $\sqrt{81}$  [1]
  - 3.2  $\sqrt{\frac{36}{4}}$  [2]
  - 3.3  $\sqrt{3^2 + 4^2}$  [2]
  - 3.4  $\sqrt{16x^{16}}$  [2]
4. If  $x = 3$ , determine:
  - 4.1  $4^x$  [2]
  - 4.2  $\sqrt[3]{27}$  [2] **[11]**

## Tutorial

I demonstrate knowledge and understanding of:		Learning outcomes		0000	000	00	0
1.	natural numbers (N) and whole numbers (N0)	1.1					
<i>continued on next page</i>							

[illegible]



3. Determine the following without using your calculator.

3.1  $\sqrt{36 + 64}$  [2]

3.2  $\sqrt[3]{2^9}$  [2]

3.3  $\sqrt{2\frac{7}{9}}$  [3]

3.4  $\sqrt{0,04}$  [2]

3.5  $\sqrt{100 - 36}$  [2]

3.6  $\sqrt[3]{8 \times 27}$  [2]

3.7  $(\sqrt{9})^2$  [2]

3.8  $\sqrt[3]{64 - 1}$  [2] **[17]**

4. Determine  $\sqrt[3]{1\ 728}$  using prime factors, without using a calculator.  
[5]

5. Bonus question

If (n) means  $n^n$  what is the value of ((2)) ? [2]

Enrichment Exercise for the quick learner

(Learning unit1)

Each question has five possible answers. Only one answer is correct. Place a cross (X) over the letter that indicates the correct answer.

1. If n and p are both odd, which of the following will be even?

a)  $np$  b)  $n^2p + 2$  c)  $n+p+1$  d)  $2n+3p+5$  e)  $2n+p$

2. R 120 is divided amongst three men in the ratio 3 : 4: 9. The one with the smallest share will receive

...

a) R16 b) R20 c) R22,50 d) R24,50 e) R40

3. How many triangles are there in the figure?

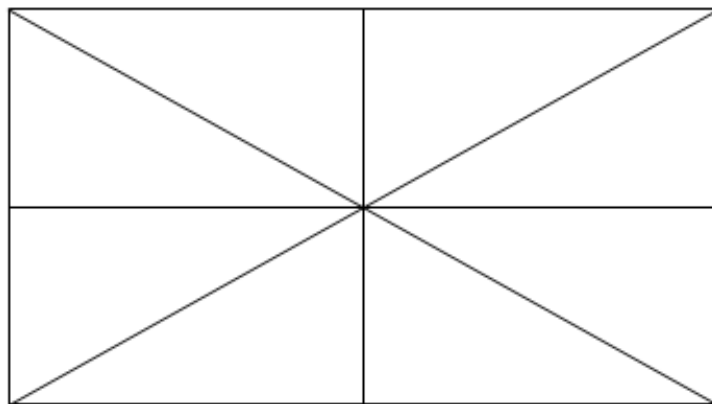


Figure 1.4

a) 8 b) 12 c) 14 d) 16 e) 20

4. A decagon has 2 interior angles of  $120^\circ$  each. If all the remaining angles are of the same size, each angle will be equal to ...

a)  $15^\circ$  b)  $30^\circ$  c)  $120^\circ$  d)  $150^\circ$  e)  $165^\circ$

5. The last digit of the number  $3^{1993}$  is ....



- a) 1 b) 3 c) 6 d) 7 e) 9
6. The figure below has 5 squares. If  $AB = 6$ , the area of the figure is...

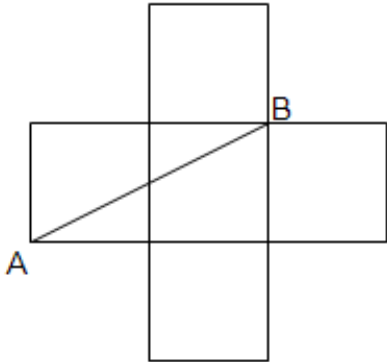


Figure 1.5

- a) 12 b) 20 c) 24 d) 36 e) impossible

1.2.6 Assessment

Learning outcomes(LOs)
LO 1
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Assessment standards(ASs)
We know this when the learner :
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continued on next page

1.6 estimates and calculates by selecting suitable steps for solving problems that involve the following; 1.6.2 multiple steps with rational numbers (including division with fractions and decimals); 1.6.3 exponents.

Table 1.19

**1.2.7****1.2.8 Memorandum****1.2.8.1 CLASS ASSIGNMENT 2**

- 1.1  $48 = 2^4 \times 3$ ;  $60 = 2^2 \times 3 \times 5$ ;  $450 = 2 \times 3^2 \times 5^2$ ;  
 $P48 = \{2, 3\}$ ;  $P60 = \{2, 3, 5\}$ ;  $P450 = \{2, 3, 5\}$ ;  
 2.1 i)  $= (2^{10})$   
 $= 2^5$   
 $= 32$   
 ii)  $= (2^3 \times 5^3)$   
 $= 2 \times 5$   
 $= 10$   
 2.2 a) 36  
 b) 192  
 c) 1  
 d) 1  
 e) 2  
 f) 17  
 g) 63  
 h) 9  
 i) 10  
 j) 4  
 k) 27  
 l)  $8 \times 6$

**1.2.8.2 HOMEWORK ASSIGNMENT 2**

- 1.1  $= (2^{12})$   
 $= 2^4$   
 $= 16$   
 1.2  $= (2^4 \times 3^4)$   
 $= 2 \times 3$   
 $= 6$   
 2.1  $= 3^2 = 9$   
 2.2  $5a^2b^5$   
 2.3  $= \times 3 =$   
 $= 1,2$   
 2.4:  $4 + 64 = 68$   
 •  $:2(8) = 16$   
 •  $:13$   
 2.7  $()^2 = 54$   
 2.8  $= 36$   
 •  $:2(9) = 18$   
 •  $:9 - 27 = -18$

### 1.2.8.3 CLASS ASSIGNMENT 3

21. *LCM*: Lowest common multiple

*LCM* of 2, 6, 12 :

24 *HCF*: Highest common factor

*HCF* of 24 and 48 :

$$2. \ 38 = 2 \times 19$$

$$57 = 3 \times 19$$

$$95 = 5 \times 19$$

$$HCF = 19$$

$$LCM = 19 \times 2 \times 3 \times 5$$

$$= 570$$

TUTORIAL 1

$$1.1 = 8$$

$$1.2$$

- $2^3 \cdot 3^{7,5}$
- $:3(3 + 4) = 21$
- $:81$
- $:16$

1.7 :125

$$2.1 :3 + 2 + 4 = 9$$

$$9 \div 3 = 3 \text{ Yes!}$$

$$2.2: 324 = 2^2 \times 3^4$$

$$2.3: = (2^2 \times 3^4)$$

$$= 2 \times 3^2$$

$$= 18$$

$$2.4: \text{Yes! } 18 \times 18 = 324 / 18^2 = 324$$

- $:9$
- $: \frac{6}{2} = 3$

$$3.3: \sqrt{9+16} = \sqrt{25} = 5$$

$$3.4: 4x^8$$

- $:4^3 = 64$
- $:3$

### 1.2.8.4 ENRICHMENT EXERCISE

1. d

2. c

3. d

$$4. \frac{180(10-2)}{10} = 144^\circ \text{ (one angle) } (1440 - 240) \div 8 = 150 \text{ (d)}$$

5. b  $3^{1992}$  ends on 1

6. d  $AB = 6$

$$(2x)^2 + x^2 = 36$$

$$4x^2 + x^2 = 36$$

$$5x^2 = 36$$

TEST 1

- $:23, 29$

- :1, 2, 3, 6, 12
  - :4, 6, 12
2. : $* 2 \ 1 + 2 + 1 + 3 + 1 + 5 + 6 + 3 = 22$
- 3.1  $\sqrt{100} = 10$
- 3.2  $2^3 = 8$
- 3.3  $\sqrt{\frac{25}{9}} = \frac{5}{3} = 1 \frac{2}{3}$
- 3.4  $\sqrt{\frac{4}{100}} = \frac{2}{10} = 0,2 \ / \ \frac{1}{5}$
- 3.5  $\sqrt{64} = 8$
- : $2 \times 3 = 6$
  - :9
  - : $4 - 1 = 3$
4.  $\sqrt[3]{2^6 \times 3^3} = 2^2 \times 3$   
 $= 4 \times 3$   
 $= 12$
5.  $(2) = 2^2 = 4$   
 $(4) = 4^4 = 256$

## 1.3 Algebra<sup>3</sup>

### 1.3.1 MATHEMATICS

#### 1.3.2 Grade 8

#### 1.3.3 THE NUMBER SYSTEM

#### 1.3.4 (Natural and whole numbers)

#### 1.3.5 Module 3

#### 1.3.6 ALGEBRA

##### ALGEBRA

##### CLASS ASSIGNMENT1

- Discover ALGEBRA step by step...
- In Algebra, we make use of letters in the place of unknowns (numbers that we do not know).
- Letters represent variables (values that may vary) and numbers are the constants (the values remain the same).

Look at the polynomial, for example

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<sup>3</sup>This content is available online at <<http://cnx.org/content/m31088/1.1/>>.

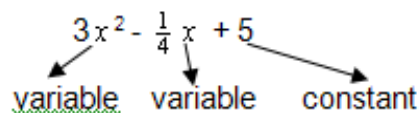


Figure 1.6

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From the above, you will be able to recognise the following:

- The number of terms (terms are separated by + and - signs): 3 terms
- Coefficient of  $x^2$  (the number immediately before  $x^2$ ): 3
- Coefficient of  $x$  (the number immediately before  $x$ ):  $-\frac{1}{4}$
- Constant: 5
- The degree of expression (highest power of  $x$ ): 2
- The expression is arranged in *descending* powers of  $x$ .
- $3x^2$  means  $3 \times x^2$  (3 multiplied by  $x^2$ )
- $x^2$  means  $(x) \times (x)$  ( $x$  multiplied by  $x$ )
- What happens to (+) and (-) signs during multiplication and division?

Here you have it:

- (+)  $\times$  of  $\div$  (+) = (+)
- (-)  $\times$  of  $\div$  (-) = (+)
- (+)  $\times$  of  $\div$  (-) = (-)

1. Study the following in your groups and supply the answers:

$$\frac{\left(\frac{1}{4}x^2 - x\right)}{4} + 6$$

- Indicate the following:

1.1 number of terms

1.2 coefficient of  $x$

1.3 constant

1.4 degree of the expression

2. Now we can use variables to define the following with the magical language of mathematics — i.e. algebraic expressions.

See if you can define these in the form of algebraic expressions:

Given Algebraic Expression

2.1 The sum of a number and 9

2.2 A number multiplied by 7

2.3 The difference between  $a$  and  $b$

2.4 6 less than a number reduced by 7

2.5 The product of a number and  $b$

2.6 Quotient of a number and 7

2.7 Square of  $a$

2.8 Square root of  $a$

2.9 Subtract the difference between  $a$  and  $b$  from their product

3. The following are referred to as flow diagrams – They consist of a) input b) formula in which the input number is substituted c) output  
Complete (a), (b) and (c)

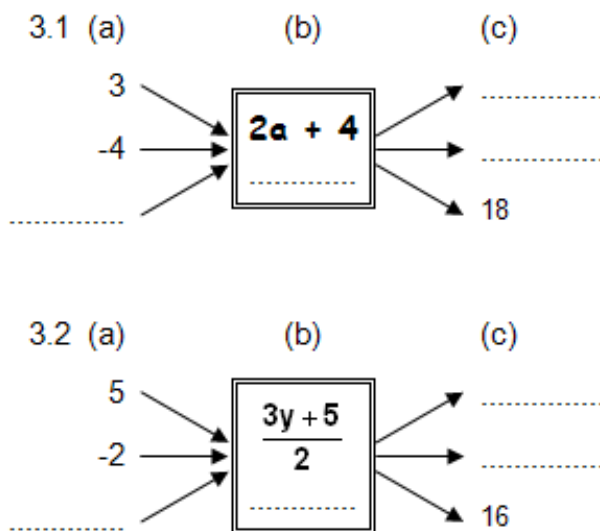


Figure 1.7

4. See if you can determine a formula for the following and complete the table.

$x$	2	5	8	10	15	47
$y$	7	11	17			

Table 1.20

formula:  $y =$

#### HOMEWORK ASSIGNMENT 1

1. Determine a formula for each of the following and complete the table.

1.1 formula:  $y =$  .....

$x$	2	5	8	9	12	20
$y$	10	16	22			

Table 1.21

1.2 formula:  $y =$  .....

$x$	3	7	10	9	12	20
$y$	12	32	47			

**Table 1.22**

1.3 formula:  $y = \dots\dots\dots$

$x$	1	3	4	9	12	20
$y$	1	9	16			

**Table 1.23**

1.4 formula:  $y = \dots\dots\dots$

$x$	1	2	3	6	7	10
$y$	1	8	27			

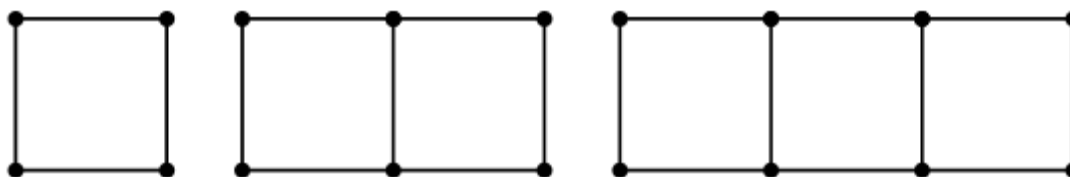
**Table 1.24**

1.5 formula:  $y = \dots\dots\dots$

$x$	1	2	4	9	12	20
$y$	2	5	17			

**Table 1.25**

2. The sketch shows matches arranged to form squares and combinations of squares.

**Figure 1.8**

2.1 Make a sketch to show four squares and indicate how many matches were used.

Matches?  $\dots\dots\dots$

2.2 Can you determine a formula that will provide a quick way for determining how many matches you will need to form ( $x$ ) number of squares?

$y = \dots\dots\dots$  (with  $y$  representing the number of matches)

2.3 Now make use of your formula to determine how many matches you will need to form 110 squares.

2.4 Determine how many squares you will be able to form with 2 005 matches.

3. Examine the following expression and answer the questions that follow:

$$-\frac{1}{4}a + \frac{a^2}{5} + 7 + 3a^3$$

3.1 Arrange the expression in ascending powers of  $a$ .

3.2 Determine:

3.2.1 number of terms

3.2.2 coefficient of  $a^2$

3.2.3 degree of the expression

3.2.4 constant term

3.2.5 the value of the expression if  $a = -2$

4. Write an algebraic expression for each of the following.

4.1 the product of  $a$  and  $p$ , multiplied by the sum of  $a$  and  $p$ .

4.2 the sum of  $a$  and  $p$ , multiplied by 3

4.3 the quotient of  $a$  and  $p$  multiplied by 3

4.4 the cost of a bus trip is  $p$  rand per km. Calculate the cost of the entire trip if the distance travelled is 45 km.

4.5 5 is added to the product of 3 and  $a$ , and the answer is reduced by the sum of 9 and  $b$

5. You rent a car at Cape Town International airport at R 125,50 per day.

5.1 Compile a table to indicate how much it will cost you in hire for the following periods: 6; 7; ..... 12 days.

5.2 Determine a formula for representing the data with  $y$  (total cost) and  $x$  (number of days).

5.3 What will the total hiring costs for  $2\frac{1}{2}$  months come to?

6. How many terms in each of the following expressions?

6.1  $ab + \frac{m}{n} - 2(a + b)$

6.2  $(p + q + r)3 - 4r^2$

6.3  $m/n + 7m^2 \div 5 \times p - q \times r$

6.4  $(6 \times q) \div (r \times 7)$

6.5  $\frac{mn - pr - a}{5}$

**Assessment**





[illegible]

accurately multiply and divide the signs (+ / -); (Lo 2.4; 2.8.4)										Problem solving			
write algebraic expressions; (Lo 2.4; 2.2; 2.8.4)										Independence			
determine the formulas for flow diagrams and tables. (Lo 2.1; 2.3; 2.4; 2.7)													

Table 1.26

[U+F04A] *good* [U+F04B] *average* [U+F04C] *not so good*

Comments by the learner:			My plan of action:			My marks:		
I am very satisfied with the standard of my work.			<		<i>Date:</i>			
I am satisfied with the steady progress I have made.					Out of:			
I have worked hard, but my achievement is not satisfactory.					<b>Learner:</b>			
I did not give my best.			>					

Table 1.27

Comments by parents:		Comments by teacher:
Parent signature: <i>Date:</i>		Signature: <i>Date:</i>

Table 1.28

### 1.3.7 Assessment

Learning outcomes(LOs)
LO 2
Patterns Functions and AlgebraThe learner will be able to recognise, describe and represent patterns and relationships, as well as to solve problems, using algebraic language and skills.
<i>We know this when the learner :</i>
2.1 investigates and extends numerical and geometrical patterns to find relationships and rules, including patterns that:2.1.1 are presented in physical or diagrammatic form;2.1.2 are not limited to series with constant difference or ratio;2.1.3 occur in natural and cultural contexts; 2.1.4 are created by the learner him/herself;2.1.5 are presented in tables;2.1.6 are presented algebraically;
2.2 describes, explains and justifies observed relationships or rules in own words or in algebra;
2.3 represents and uses relationships between variables to determine input an output values in a variety of ways by making use of:2.3.1 verbal descriptions;2.3.2 flow diagrams;2.3.3 tables;2.3.4 formulas and equations;
2.4 builds mathematical models that represent, describe and provide solutions to problem situations, thereby revealing responsibility towards the environment and the health of other people (including problems in the contexts of human rights, social, economic, cultural and environmental issues);
2.7 is able to determine, analyse and interpret the equivalence of different descriptions of the same relationship or rule which can be represented:2.7.1 verbally;2.7.2 by means of flow diagrams;2.7.3 in tables;2.7.4 by means of equations or expressions to thereby select the most practical representation of a given situation;
2.8 is able to use conventions of algebraic notation and the variable, reconcilable and distributive laws to:2.8.1 classify terms like even and odd and to account for the classification;2.8.2 assemble equal terms;2.8.3 multiply or divide an algebraic expression with one, two, or three terms by a monomial;
2.8.4 simplify algebraic expressions in bracketed notation using one or two sets of brackets and two types of operation;2.8.5 compare different versions of algebraic expressions having one or two operations, select those that are equivalent and motivate the selected examples;2.8.6 rewrite algebraic expressions, formulas or equations in context in simpler or more usable form;
2.9 is able to interpret and use the following algebraic ideas in context: term, expression, coefficient, exponent (or index), basis, constant, variable, equation, formula (or rule).

Table 1.29

### 1.3.8

### 1.3.9 Memorandum

#### 1.3.9.1 CLASS ASSIGNMENT 1

- 2
- 

$$-\frac{1}{4} \quad (1.1)$$

- 6
- 2

2.1  $x + 7$

2.2  $x + 7$

2.3  $a - b$

- $(x + 7) - 6$

$$= x - 13$$

- $x \times b = xb$

- 

$$\frac{x}{7} \quad (1.2)$$

- $a^2$

- 

$$\sqrt{a} \quad (1.3)$$

$$2.9 \text{ ab} - (a - b)$$

$$3.1 \text{ ac}$$

$$7 - 4$$

$$3.2 \text{ ac}$$

$$9 - \frac{1}{2}$$

$$4. \text{ 21; 31; 95; } y = 2x + 1$$

### 1.3.9.2 HOMEWORK ASSIGNMENT 1

- $y = 2x + 6$

- $y = 5x - 3$

- $y = x^2$

- $y = x^3$

- $y = x^2 + 1$

- Sketch:  $(3 \times 4) + 1 = 13$

- $y = 3x + 1$

- $y = 3(110) + 1 = 331$

- $(2\,005 - 1) \div 3 = 668$

- $7 - \frac{1}{4}a + \frac{a^2}{5} + 3a^3$

- 4

- 

$$\frac{1}{5} \quad (1.4)$$

- 3

- 7

- $-\frac{1}{4}\left(-\frac{2}{1}\right) + \left(\frac{-2}{5}\right)^2 + 7 \cdot 3(-2)^3$

$$\begin{aligned} &= \frac{1}{2} + \frac{4}{5} + 7 - 24 \\ &= \frac{5+8+70-240}{10} \\ &= \frac{-157}{10} = -15,7 \end{aligned}$$

- $ap + (a + p)$

- $3(a + p)$

- $\frac{a}{p} + 3$

- $45p$

- $(3a + 5) - (9 + b)$

5.1

Days	6	7	8	9	10	11	12
R	753	878,50	1 004	1 629,50	1 255	1 380,50	1 506

Table 1.30

- $y = 125,5x$
- $2 \frac{1}{2}$  months  $(2 \times 30) + 15$  75 x R125,50 = R9 412,50

or  $(30 + 31 + 15) 76 \times \text{R}125,50 = \text{R}9\,538,00$

- 3
- 2
- 3
- 1
- 1

## 1.4 Addition and subtraction in Algebra<sup>4</sup>

### 1.4.1 MATHEMATICS

#### 1.4.2 Grade 8

#### 1.4.3 THE NUMBER SYSTEM

#### 1.4.4 (Natural and whole numbers)

#### 1.4.5 Module 4

#### 1.4.6 ADDITION AND SUBTRACTION IN ALGEBRA

#### CLASS ASSIGNMENT1

- **Discover more and more about addition and subtraction in ALGEBRA ....**

- When we do addition and subtraction in Algebra, we can only add together or subtract like terms (terms of the same type) from one another.
- e.g.  $3a + 5a = 8a$  ( $a$  is the same for both terms)
- e.g.  $3a + 5a^2$  (cannot be added together, because one term is  $a$  and the other  $a^2$  - not of the same type)
- remember:  $-8(+5)$  means:  $-8 \times (+5) = -40$  (two signs must not be placed next to one another; multiply the two signs by one another)

1.Can you still do the following with integers?

- 1.1:  $-8 - 12 + 8$
- 1.2:  $7 - (+8) - (-6)$
- 1.3:  $15 - (-9) + (+7)$
- 1.4:  $2(-6) - 5(-6)$
- 1.5:  $50 - 70 + 15$

---

<sup>4</sup>This content is available online at <<http://cnx.org/content/m31100/1.1/>>.





[illegible]

Table 1.31

Comments by the learner:			My plan of action:			My marks:		
I am very satisfied with the standard of my work.			<		<i>Date:</i>			
<i>continued on next page</i>								

I am satisfied with the steady progress I have made.					Out of:			
I have worked hard, but my achievement is not satisfactory.					Learner:			
I did not give my best.			>					

Table 1.32

Comments by parents:		Comments by teacher:
Parent signature: <i>Date</i>		Signature: <i>Date</i> :

Table 1.33

1.4.7 Memorandum

1.4.7.1 CLASS ASSIGNMENT 1

- -12
- 5
- 31
- 18
- -5
  
- 4a
- $10a + 9 a$
  
- $-a + 8b - 38c$
- $-26a^2 - 16a - 12b - 10$
  
- $-7a + 3 - (6a - 9)$

$$= -7a + 3 - 6a + 9$$

$$= -13a + 12$$

$$\bullet \quad 18a^2 - 15 - (-7a^2 - 5a + 8)$$

$$= 18a^2 - 15 + 7a^2 + 5a - 8$$

$$= 25a^2 + 5a - 23$$

$$\bullet \quad -15x^2 - 7x + 20 - (-6x^2 + 76)$$

$$= -15x^2 - 7x + 20 + 6x^2 - 76$$

$$= -9x^2 - 7x - 56$$

### 1.4.7.2 HOMEWORK ASSIGNMENT 1

1.  $3p^2 - 17p - 25$
2.  $8 - 7a^2 - (-5p^2 - 3p)$   
 $= 8 - 7a^2 + 5p^2 + 3p$   
 $-2a^2 + 3p + 8$
3.  $1 - (6a - 8y) = 1 - 6a + 8y$
4.  $3a^3 + 6a - 7a - 5 - 16a^3 + 8a^2 - 34a - 16 - 15a$   
 $= -13a^3 + 8a^2 - 50a - 21$
5.  $24p + 28y - 37a$
6.  $-23a^2 + 3a + 5$
7.  $12a^2 + 8a - 8$
8.  $-6a + 6 - 5a^2$

## 1.5 Multiplication in algebra<sup>5</sup>

### 1.5.1 MATHEMATICS

#### 1.5.2 Grade 8

### 1.5.3 THE NUMBER SYSTEM

#### 1.5.4 (Natural and whole numbers)

#### 1.5.5 Module 5

### 1.5.6 MULTIPLICATION IN ALGEBRA

#### CLASS ASSIGNMENT 1

- Discover more and more about multiplication in ALGEBRA!

1. Indicate what the following will be equal to...

1.1:  $2 \times 2 \times 2 = \dots\dots\dots$  (and what the exponent form will be  $\dots\dots\dots$ )

1.2:  $2^2 \times 2^2 \times 2^3 \times 3^2 \times 3^3 = \dots\dots\dots$

(and what the exponent form will be  $\dots\dots\dots$  )

- $a \times a \times a = \dots\dots\dots$

---

<sup>5</sup>This content is available online at <http://cnx.org/content/m31107/1.1/>.

1.4:  $a^2 \times a^2 \times a^3 = \dots\dots\dots$

Now write out a general rule for the multiplication of exponents:

1.5:  $2(a - b) = \dots\dots\dots$

**distributive law:**  $(2 \times a) - (2 \times b)$

1.6:  $3^0 = \dots\dots\dots$

1.7:  $a(a + b)^0 = \dots\dots\dots$

Therefore: (anything) to the power of 0 =  $\dots\dots\dots$

1.8:  $3^1 = \dots\dots\dots$

1.9:  $1^{200} = \dots\dots\dots$

2. What does each of the following mean? Also provide the simplified answer for each one

2.1:  $a^2 =$

2.2:  $2ab =$

2.3:  $-3(a + b) =$

2.4:  $4(a)^2 =$

2.5:  $(a^3)^2 =$

2.6:  $(3a^2)^3 =$

2.7:  $2p \times 3p =$

2.8:  $ab^2 \times a^2b^3 \times ab^6 =$

2.9:  $(\frac{1}{2}a^3)^4 =$

2.10:  $2(a^3)^2 =$

2.11:  $6(2a - 3b) =$

2.12:  $-7a(a^2 - 2b^2) =$

3. Can you recall the order of operations for the following? Write it down.

3.1 Now make use of everything you have learnt up till now to calculate the following:

3.1.1:  $a \times a \times aaa + a^4$

3.1.2:  $2(a + b) - 3(a - b)$

3.1.3:  $3a \times 2a^2b + 5a^2 \times (-3ab)$

3.1.4:  $-5a(a - b^3) + 7ab^3 - 2a^5$

3.1.5:  $-3(a^2b^4)^2 - 5a^3(-2a^4b^2)^3$

4. What is the meaning of the word substitution?

Provide an example as explanation:

5. Supposing that  $a = 5$  ;  $b = -1$  and  $c = 3$  , calculate the value of each of the following:

5.1:  $5a^2 - 3b$

5.2:  $\frac{2ab^2}{3a}$

5.3:  $\frac{a+b^2}{a-b}$

5.4:  $(2ab^2c)^2$

5.5:  $-3ab^3 - 2ab^3c$

# HOMEWORK ASSIGNMENT 1

1. Simplify each of the following:

1.  $(a^5)^6$

1.2:  $5(3a - 7a)^2$

1.3:  $-5(3a - 2b)$

1.4:  $(3a)^2 \cdot [(2a)^2]^3$

1.5:  $p \times 2 \times m \times q$

1.6:  $w^2 \times 3b \times \frac{1}{3}b \times w$

1.7:  $-5a(3a - 5ab)$

1.8:  $(3a)^2(2a) + (4a^2)(-2a)$

1.9:  $(5ab^2)^4 - (-6b^6a^4)$

1.10:  $-6a^2b(2a^2 - 3ab^3 + 5)$

2. Supposing that  $x = -2$  and  $y = -1$  , determine the value of ...

2.1:  $(2y)(2x)^2$





solve ex- pres- sions with brack- ets; (Lo 2.2; 2.8.5)											Communication		
apply the cor- rect or- der of cal- cu- la- tions; (Lo 2.2; 2.8.5)											Problem solv- ing		
determine											Independence		
val- ues of ex- pres- sions with sub- sti- tu- tion. (Lo 2.2; 2.8.5; 1.6.2; 1.6.3)													

Table 1.34

[U+F04A] *good* [U+F04B] *average* [U+F04C] *not so good*



Comments by the learner:			My plan of action:			My marks:		
I am very satisfied with the standard of my work.			<		<i>Date:</i>			
I am satisfied with the steady progress I have made.					Out of:			
I have worked hard, but my achievement is not satisfactory.					<b>Learner:</b>			
I did not give my best.			>					

Table 1.35

Comments by parents:		Comments by teacher:
Signature: <i>Date:</i>		Signature: <i>Date:</i>

Table 1.36

### 1.5.7 Memorandum

#### 1.5.7.1 CLASWORK ASSIGNMENT 1

- $2^3$
- $2^{12}$
- $a^3$
- $a^7$

Multiply and bases are the same: you add the exponents.

- $:2a - 2b$
- $:1$

1.7 :a

- $:3$
- $:1$
- $:a \times a$
- $:2 \times a \times b$
- $:-3a - 3b$
- $:4 \times a \times a = 4a^2$
- $:a^3 \times a^3 = a^6$
- $:27a^6$
- $:6p^2$
- $:a^4 b^{11}$
- $:\frac{1}{16}a^{12}$
- $:2a^6$
- $:12a - 18b$
- $:-7a^3 + 14ab^2$

3.1 :1: ( )

:2: of

3:  $\times$  or  $\div$  from left to right

4:  $+$  or  $-$  from left to right

- $:a^5 + a^4$
- $:2a + 2b - 3a + 3b = -a + 5b$
- $:-18a^6 b^2$
- $:-5a^2 + 5ab^3 + 7ab^3 - 2a^5$

$:-5a^2 + 12ab^3 + 7ab^3 - 2a^5$

- $:-3a^4 b^8 + 10a^{15} b^6$

4. put another value in unknown place

- $:5(5)^2 - 3(-1)$

$= 125 + 3 = 128$

- $:\frac{2(5)(-1)^2}{3(5)}$

$= \frac{10}{15} = \frac{2}{3}$

- $:\frac{(5)+(-1)^2}{5-(-1)}$

$= \frac{6}{6} = 1$

- $: [2(5)(-1)^2(3)]^2$

$= [30]^2 = 900$

- $:-3(5)(-1)^3 - 2(5)(-1)^3(3)$

$= 15 + 30 = 45$

## 1.5.7.2 CLASSWORK ASSIGNMENT1

- $:9^{30}$
- $:5(-4a)^2 = 80a^2$
- $:-15a + 10b$
- $:9a^2.64a^6 = 576a^8$
- $:2mpq$
- $:b^2 w^3$
- $:-15a^2 + 25a^2b$
- $:6a^3 - 8a^3 = -2a^3$
- $:625a^4b^8 + 6a^4b^6$
- $:-12a^4b + 18a^3b^4 - 30a^2b$

- $: [2(-1)][2(2)]^2$

$$= (-2)(16) = -32$$

- $:-3(-2)^3 - 2(-1)^5$

$$= 24 + 2 = 26$$

- $: [2(-1) + 2(-2)]^2$

$$= [-2 - 4]$$

$$= (-6)^2$$

$$= 36$$

- $: 2 + (-3) + = 4$

- $: 4(2) - 2(-3) - 3(5)$

$$= 8 + 6 - 15 = -1$$

- $: 2[(2)^2 + (5)^2] - (-3)^2$

$$= 2[4 + 25] - (-3)^2$$

$$= 58 - 9 = 49$$

$$3.4 : \frac{2}{3} + \frac{-3}{4} - 5$$

$$= \frac{-1}{4} - 5 = 5 \frac{1}{4}$$

$$3.5 : 3(2)[-3 + 5] - 2[2 + (-3)^2]$$

$$= 6[2] - 2[11]$$

$$= 12 - 22$$

$$= -10$$

- $: 5a^4(5a^3 + 5a - 6)$

$$= 25a^7 + 25a^5 - 30a^4$$

- $: 4ab(a - b + 2c) + 5ab(2a + 5b - 3c)$

$$= 4a^2b - 4ab^2 + 8abc + 10a^2b + 25ab^2 - 15abc$$

$$= 14a^2b + 21ab^2 - 7abc$$

## 1.6 Division in algebra<sup>6</sup>

### 1.6.1 MATHEMATICS

#### 1.6.2 Grade 8

### 1.6.3 THE NUMBER SYSTEM

#### 1.6.4 (Natural and whole numbers)

#### 1.6.5 Module 6

### 1.6.6 DIVISION IN ALGEBRA

#### CLASS ASSIGNMENT 1

- Discover more and more about division in ALGEBRA!
- Write the following fraction in its simplest form in  $\frac{45}{36} = \dots\dots\dots$
- Like common fractions, you can also write algebraic fractions in the simplest form.

What would the following be in its simplest form?  $\frac{6a^2b}{3ab} = \dots\dots\dots$

Yes, it is actually like this:  $\frac{6 \times a \times a \times b}{3 \times a \times b} = \frac{2 \times a \times 1 \times 1}{1 \times 1 \times 1}$

(Now you may cancel all the like terms above and below)(What remains above and below? Just write down the answer)

- There is a shortcut for terms with exponents:  $\frac{m^5}{m^7} = \dots\dots\dots$

Are you able to identify the shortcut? Yes,  $7 - 5 = 2$ . Therefore  $m^2$  what remains below the line.

Answer:  $\frac{1}{m^2}$

1. Now simplify the following:

1.1  $\frac{18m^5}{9m^2} \dots\dots\dots$

1.2  $\frac{15p^4y^7}{3p^7y^3} \dots\dots\dots$

1.3  $\frac{(4m^2)^2}{2m^6} \dots\dots\dots$

1.4  $\frac{4(2m^2)^5}{2(m^2)^2} \dots\dots\dots$

1.5  $\frac{8a^2(a^2)^2}{8a^2} \dots\dots\dots$

1.6  $\frac{25a^2b^3c^4 \cdot 4ab^3c^2}{15a^3b^4c^5} \dots\dots\dots$

2. Remember:  $\frac{1}{3}b(9a) = \frac{1 \times b}{3} \times \frac{9a}{1} = \frac{b \times 9a}{3} = \frac{9ab}{3} = 3ab$

Therefore:  $\frac{1}{3}$  means: **x 1 ÷ 3**

Now try to simplify the following:  $\frac{1}{3} (4a - 6b)$

2.1 Write each of the following in simplified form.

2.1.1:  $\frac{1}{5} \times a \dots\dots\dots$

2.1.2:  $\frac{1}{5}(2a^2 - 15) \dots\dots\dots$

2.1.3:  $(2a - 8b + 12c) \div 2 \dots\dots\dots$

2.1.4:  $\frac{6a^2b^2c^3 - 15a^4b^6c^7 + 27b^9c^{10}}{3a^2b^4c^3} \dots\dots\dots$

2.1.5:  $\frac{7m^2pq^9 - 49m^6n^7 - 35p^6q^{12}}{-7mn^3q^4} \dots\dots\dots$

#### HOMEWORK ASSIGNMENT 1

1. Simplify:

1.1  $\frac{-56p^7q^7}{-8mn^3q^4} \dots\dots\dots$

<sup>6</sup>This content is available online at <<http://cnx.org/content/m31108/1.1/>>.



express algebraic fractions in their simplest form; (Lo 2.2; 1.6.2; 2.8.3; 2.8.4; 2.8.5; 2.8.6)										Collaborating			
calculate the shortest path for terms with exponents. (Lo 2.2; 1.6.2; 1.6.3)										Organising en man- ag- ing			

*continued on next page*



I have worked hard, but my achievement is not satisfactory.					<b>Learner:</b>			
I did not give my best.			>					

Table 1.38

Comments by parents:		Comments by teacher:
Signature: <i>Date:</i>		Signature: <i>Date:</i>

Table 1.39

Tutorial 2: (Algebra)

Total: 70

Question 1

**A.** Indicate whether the following statements are TRUE or FALSE and improve the wrong statements.

1. The base of  $2x^3$  is  $2x$ .
2. The number of terms in the expression are THREE:  $3(5a + 2) + 5b - 6$
3.  $-10\frac{1}{2} < -10,499$
4.  $-2^2 = -4$
5. The first prime number is 1.
6.  $0 \div 6 = 0$
7. The 5 in  $5^3$  is known as the power.
8.  $-3 > -6$
9. The square of van 8 is 64.
10. The coefficient of  $x$  in  $4xy^2$  is 4.
11.  $7(x - 2y) = 7x - 2y$
12.  $2x^2 + 3x^2 = 5x^4$
13.  $5 - 2 + (-2) = 1$
14.  $\sqrt[3]{a^6b^{12}} = a^2b^4$

[14]

**B.** Complete the following:

1. The coefficient of  $a$  in  $3ab$  is ...
2. The exponent  $5^{a+b}$  is ....

[2]

[16]

Question 2

Here matches are arranged to form squares.



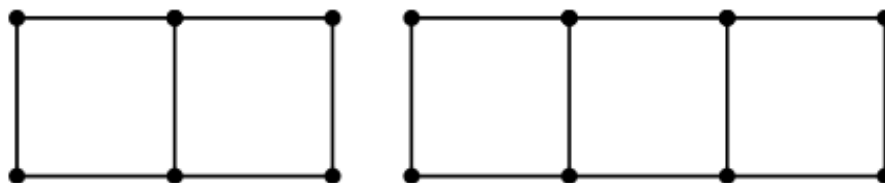


Figure 1.9

1. Complete the following table. [4]

Number of squares	2	3	5	9
Number of matches				

Table 1.40

2. How many matches are required to build 150 squares? [2]  
 3. How many squares can be built with 1 000 matches? [2]  
 [8]

Question 3

**A.** Supposing  $a = 3$  ;  $b = -2$  and  $c = 6$ , determine the value of:

1.  $2a(3b + 5c)$  [3]

2.  $\frac{a-b-c}{b-c}$  [4]

**B.** Addition and subtraction:

1. Add:  $3a + 4b - 6c$  ;  $-6b + 3c + 2a$  ;  $5c - 3b$  ;  $a - 2c$  [3]

2. Subtract  $8x + 2y + 5$  from  $10x - 2y + 4$  [3]

[13]

Question 4

Simplify each of the following:

1.  $7a^2bc - 2ab^2c - 3ba^2c + acb^2$  [2]

2.  $5a^2 \times 3a^3 - 3a^4 \times 2a$  [3]

3.  $3(2a^2b^3)^2 \cdot (-ab)^3$  [4]

4.  $-5ab^2(3a^2 - 4b)$  [2]

5.  $2a(7a + 4) - 3(a + 3a^2) - (-4a^2 - a)$  [4]

6.  $\frac{(-3ab)^2(2a)^3}{4(ab)^2}$  [4]

7.  $\frac{14a^4b^3}{6c^2} \times \frac{12c^4}{-7a^3b^2}$  [3]

[22]

Question 5

Supposing  $A = a^2b + 5ab^2 - 6ab$  and  $B = ab$ , determine the following:

5.1  $\frac{A}{B}$  [3]

5.2  $\frac{3A}{B}$  [4]

5.3  $\frac{A+B}{B}$  [4]

[11]

TOTAL: 70

Algebra**Tutorial**

I demonstrate knowledge and understanding of:		Learning outcomes		0000	000	00	0
1.	different terms that can be distinguished in a polynomial;	2.4; 2.8.2; 2.9					
2.	identifying the coefficient of an unknown;	2.4; 2.9					
3.	identifying the constant in a polynomial;	2.4; 2.9					
4.	determining the degree of an expression;	2.4; 2.8.1; 2.9					
5.	arranging the expression in a descending order;	2.4; 2.9					
6.	the correct usage of signs ( + / - ) in an expression;	2.4; 2.8.4 & .6					
<i>continued on next page</i>							



14.	expressing fractions in their simplest form;	2.2; 2.4; 1.6.2					
15.	expressing algebraic fractions in their simplest form.	2.4; 1.6.2; 2.8.3					
16.							
17.							

Table 1.41

The learner's ...	1	2	3	4
work is...	Not done.	Partially done.	Mostly complete.	Complete.
layout of the work is...	Not understandable.	Difficult to follow.	Sometimes easy to follow.	Easy to follow.
accuracy of calculations...	Are mathematically incorrect.	Contain major errors.	Contain minor errors.	Are correct.

Table 1.42

	My BEST marks:				Comments by teacher:
<i>Date:</i>					
Out of:					
<b>Learner:</b>					
					Signature: <i>Date:</i>

Table 1.43

Parent Signature: *Date:*

Test 2: (Algebra)

Total: 60

1. Simplify:

1.1:  $17a^2bc - 21ab^2c - 3ba^2c + 4acb^2$  [2]

1.2:  $5a^2 \times 3a^3 - 3a^4 \times 5a$  [3]

1.3:  $7ab - (-4ab)$  [2]

1.4:  $3(2a^2b^3)^3 \cdot (-a^2b^2)^3$  [3]

1.5:  $-7ab^2(3a^2 - 5b)$  [2]

1.6:  $5a(3a + 5) - 2(2a + 4a^2) - 2a(-3a)$  [4]

1.7:  $\frac{(-2ab)^2(3a)^3}{4(ab^2)^2}$  [4]

[20]

2. If  $a = 3$  ;  $b = -2$  and  $c = 6$ , determine the values for:

2.1  $3a(2b + 4c)$  [3]

2.2  $\frac{a - b - c}{b + c}$  [4]

2.3  $\frac{3c}{a \cdot b \cdot c}$  [3]

2.4  $\frac{9a^5}{-3a^3}$  [3]

[13]

3. Given:  $5a^2 - (m + n)a - 5p$

3.1 How many terms are there in the above expression? ..... [1]

3.2 Write down the coefficient of  $p$ . ..... [1]

3.3 Write down the exponent of  $p$ . ..... [1]

3.4 What is the reciprocal of  $-5$ ? ..... [1]

[4]

4.

4.1 Determine by how much  $7a + 5b + 9c$  is bigger than  $2c + 3a - 7c$ . [3]

4.2 Determine by how much  $n + 3m + 3k$  is smaller than  $-3k - 7m + 2n$  [3]

4.3 Subtract  $x^2 - 2x + 4$  from  $5c^2 + 6x - 9$  [3]

[9]

5. Write down an algebraic expression for each of the following.

5.1:  $23m$  reduced by the square of  $n$  ..... [2]

5.2 Subtract the product of  $m$  and  $n$  from the difference between  $m$  and  $n$ . [2]

5.3 You have twenty coins.  $y$  of them are fifty-cent coins and the rest are ten-cent coins.

5.3.1 how many ten-cent coins do you have (in terms of  $y$ ) [1]

5.3.2 What is the total value of your money? [2]

[7]

6. Complete the following tables and give a formula for each in the form  $y = \dots$

6.1  $y = \dots$  [3]

$x$	3	5	7	9	10	15	
$y$	9	25					

**Table 1.44**

6.2  $y = \dots$  [4]

$x$	3	5	7	9	
$y$	11		23		38

**Table 1.45**

[7]

7. Bonus question

Study the following pattern:

$$1 = 1 \times 1$$

$$1 + 3 = 2 \times 2$$

$$1 + 3 + 5 = 3 \times 3$$

$$1 + 3 + 5 + 7 = 4 \times 4$$

Now determine:

$$1 + 3 + 5 + 7 + 9 + \dots + 21 + 23 + 25 + 27 + 29$$

2]

Enrichment exercise for the quick learner

1. If  $p$  [U+F056]  $q$  means  $3p + q^2$ , (3 [U+F056] 4) [U+F056] 5 will be equal to...  
a) 60 b) 100 c) 87 d) 72 e) 91
2. In the multiplication shown,  $S$  and  $T$  are different digits between 1 and 9. The value of  $S + T$  is ...  

$$\begin{array}{r} \text{x } 2 \quad T \\ 2150 \end{array}$$
a) 13 b) 14 c) 15 d) 16 e) 17
3. How many digits are there in  $5^8$  ?  
a) 2 b) 5 c) 6 d) 8 e) 40
4. The average of the numbers 0,1 ; 0,11 and 0,111 is ...  
a) 0,041 b) 0,107 c) 0,11 d) 0,1111 e) 0,17
5. In a certain class  $\frac{1}{3}$  of the pupils are girls. If 6 boys represent one quarter of the number of boys in the class, how many pupils are there in the class?  
a) 18 b) 24 c) 27 d) 32 e) 36
6. If  $\frac{1}{2} - x = x - \frac{1}{3}$ ,  $x$  will be equal to...  
a)  $\frac{1}{12}$  b)  $\frac{1}{6}$  c)  $\frac{5}{12}$  d)  $\frac{5}{6}$  e)  $\frac{3}{12}$
7. Calculate the value of  $x$  if .....

$$\sqrt[3]{4 + \sqrt{x}} = 2 \quad (1.5)$$

- a) 4 b) 2

## 1.6.7 Memorandum

### 1.6.7.1 CLASSWORK ASSIGNMENT 1

- $2m^3$
- 

$$\frac{5y^4}{p^3} \quad (1.6)$$

- 

$$\frac{8}{m^2} \quad (1.7)$$

- $\frac{4(32m^{10})}{2m^4} = 64m^6$

1.5  $a^4$

1.6  $\frac{20b^2c}{3}$

2.  $\frac{4a}{3} - 2b$

2.1.1  $\frac{1a}{5}$

2.1.2  $\frac{2a^2}{5} - 3$

- $a - 4b + 6c$
- $\frac{2}{b^2} - 5a^2b^2c^4 + \frac{9b^5c^7}{a^2}$
- $\frac{-mpq^5}{n^3} + \frac{7m^5n^4}{q^4} + \frac{5p^6q^8}{mn^3}$

### HOMEWORK ASSIGNMENT 1

1.1  $\frac{7p^7q^3}{mn^3}$

1.2  $\frac{-ac^2}{b} + \frac{12a^3b^5}{c^2} - \frac{8a^2}{c^2}$

1.3  $\frac{5a^2}{2} - \frac{25b}{2}$   
 $= \left( \frac{5a^2 - 25b}{2} \right)$

1.4  $\frac{a^6b^6 \cdot a^4b^8}{a^2b^3}$

$$= a^8 b^{11}$$

$$1.5 \frac{3(16k^2 p^8)}{2k^3 p^2}$$

$$= \frac{24p^6}{k}$$

- $6ab^2 + 12a^2 - (6ab)$
- $\frac{3b}{2} + \frac{3a}{b}$
- $\frac{3ab^2 + 6a^2 + 2ab}{4ab}$

$$= \frac{3b}{4} + \frac{3a}{2b} + \frac{1}{2}$$

$$3. \frac{-5ab + 15a^4 b^7}{5a^3 b^2} = -\frac{1}{a^2 b} + 3ab^5$$

TUTORIAL

QUESTION 1

A.1. False: x

1. True
2. True
3. True
4. False: 2
5. True
6. False: 5 base
7. False
8. False
9. False:  $4y^2$
10. False:  $7x - 14y$
11. False:  $5x^2$
12. True
13. True

B.1.  $3b$ 2.  $a+b$ 

QUESTION 2

1. 7; 10; 16; 28

1.  $(150 \times 3) + 1 = 451$
2.  $(1\,000 - 1) \div 3 = 333$

QUESTION 3

A.1.  $2(3)[3(-2) + 5(6)]$  $= 6[-6 + 30]$  $= 6[+24] = 144$ 2.  $\frac{3-(-2)-(6)}{(-2)-(6)}$  or  $\frac{3+2-6}{-2-6}$  $= \frac{-1}{-8} = \frac{1}{8}$ B.1.  $6a - 5b$ 2.  $2x - 4y - 1$ 

QUESTION 4

1.  $4a^2 bc - ab^2 c$
2.  $15a^5 - 6a^5 = 9a^5$
3.  $12a^4 b^6 (-a^3 b^3)$

$$= -12a^7 b^9$$

1.  $-15a^3b^2 + 20ab^3$
2.  $14a^2 + 8a - 3a - 9a^2 + 4a^2 + a$

$$= 9a^2 + 6a$$

6.  $\frac{9a^2b^2 \cdot 8a^3}{4a^2b^2} = 18a^3$
7.  $\frac{14^2a^4b^{b3}}{bc_1} \times \frac{12^2c^4c^2}{-7a^3b^2}$

$$= -4abc^2$$

QUESTION 5

$$5.1 \frac{a^2b+5ab^2-6ab}{ab}$$

$$= a + 5b - 6$$

$$5.2 \frac{3a^2b+15ab^2-18ab}{ab}$$

$$= 3a + 15b - 18$$

$$5.3 \frac{a^2b+5ab^2-5ab}{ab}$$

$$= a + 5b - 5$$

TEST

- $4a^2bc - 17ab^2c$
- $15a^5 - 15a^5 = 0$
- $7ab + 4ab = 11ab$
- $3(8a^6b^9) (-a^6b^6)$

$$= -24a^{12}b^{15}$$

- $-7a^3b^2 + 35ab^3$
- $15a^2 + 25a - 4a - 8a^2 + 6a^2$

$$= 13a^2 + 21a$$

- $3(3)[2(-2) + 4(6)]$

$$= 9[-4 + 24]$$

$$= 180$$

$$2.2 \frac{3-(-2)-(6)}{(-2)+(6)}$$

$$= \frac{3+2-6}{-2+6}$$

$$= \frac{0}{4} = 0$$

$$2.3 \frac{3(6)}{(3)(-2)(6)}$$

$$= \frac{18}{-36}$$

$$= -\frac{1}{2}$$

$$2.4 \frac{9(3)^5}{-3(3)^3}$$

$$= \frac{9(9)^3}{-3}$$

$$= -27$$

- 3
- -5
- 1
- 

$$-\frac{1}{5}$$

(1.8)

- $7a + 5b + 9c - (2c + 3a - 7c)$



$$= 7a + 5b + 9c - 2c + 3a - 7c$$

$$= 4a + 5b + 14c$$

- $-3k - 7m + 2n - (n + 3m - 3k)$

$$= -3k - 7m + 2n - n + 3m - 3k$$

$$= -6k - 10m + n$$

- $5x^2 + 6x - 9 - (x^2 - 2x + 4)$

$$= 5x^2 + 6x - 9 - x^2 - 2x + 4$$

$$= 4x^2 + 4x - 5$$

- $23m - n^2$

- $(m - n) - mn$

- $20 - y$

- $50y - 10(20 - y)$

$$= 50y - 200 + 10y$$

$$= 60y - 200$$

- $y = x^2$

$$49; 81; 100; 225$$

- $y = 3x + 2$

$$17; 29; 18$$

$$7. 15^2 = 225$$

### 1.6.7.2 ENRICHMENT EXERCISE

1. b

2. a

3. c

4. b

5. e

6. c

7. d

## 1.7 Term 2

### 1.7.1 Integers and their organisation<sup>7</sup>

#### 1.7.1.1 MATHEMATICS

#### 1.7.1.2 Grade 8

#### 1.7.1.3 INTEGERS, EQUATIONS AND GEOMETRY

#### 1.7.1.4 Module 7

#### 1.7.1.5 INTEGERS AND THEIR ORGANISATION

#### INTEGERS

#### CLASS ASSIGNMENT 1

---

<sup>7</sup>This content is available online at <http://cnx.org/content/m31111/1.1/>.

- Step by step, discover more about... what integers are, their organisation and how you can write them down....
1. What does it mean if you say a person is “negative”? Explain this in mathematical context.
  2. What do you think is a “negative number”? Use an illustration to substantiate your explanation.
  3. Give two examples of where you would use “negative” numbers on earth.
  4. Give a definition of integers:
  5. What symbol represents the set of integers?
  6. How would you represent the following on a number line (graphically)?  
 $x \geq -3$  ;  $x \in \mathbb{Z}$ .  
 (how would you express the above in words? – all integers greater than -3)

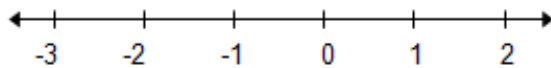


Figure 1.10

[shaded dots – indicate number is included – therefore also equal to a circle (not coloured dot) – indicates that the specific number is not included]

Different types of notations:

- Graphically: i.e. using a number line
- Set builder notation:  $\{ x \mid x \in \mathbb{Z}, x \geq -3 \}$

(read as follows: set  $x$  in which  $x \in \mathbb{Z}$  and  $x$  is greater than and equal to -3)

- Interval notation:  $[-3; \infty)$ , only real numbers can be indicated in this way.

(Numbers greater than -3 up to infinity on the positive side)

6.1 Now represent the following graphically (by means of a number line):

Draw your number line:

6.1.1  $x < 2$ ,  $x \in \mathbb{Z}$

6.1.2  $x \geq -2$ ,  $x \in \mathbb{Z}$

6.1.3  $2 \leq x < 5$

6.2 Write the following in set builder notation:

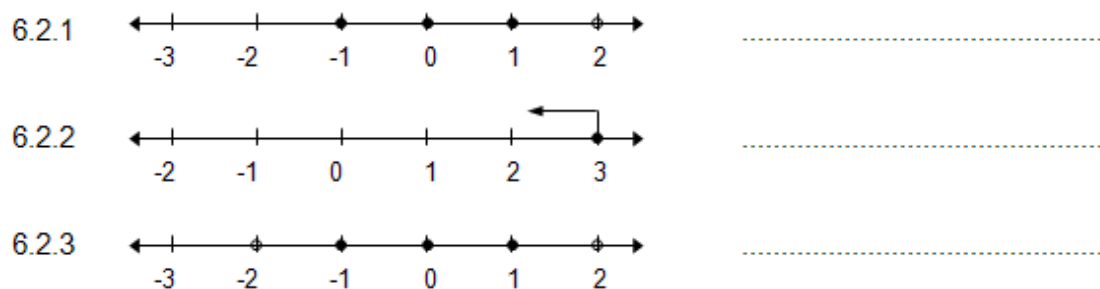


Figure 1.11

---

### CLASS ASSIGNMENT 2

- Step by step, discover more about... adding and subtracting integers

Can you still remember the following from Module 1?

- $(+) \times \text{ or } \div (+) \rightarrow$   
 $(+) \times \text{ or } \div (-) \rightarrow$   
 $(-) \times \text{ or } \div (-) \rightarrow$

(You will need the above even when adding and subtracting integers, because you have to remember: you may never have two signs next to each other, you must always multiply the two signs with each other)

Can you still remember the properties of 0 (zero)? Look at this....

$$b \times 0 =$$

$$b + 0 =$$

$$b - 0 =$$

$$\frac{b}{0} = \text{ and } \frac{0}{b} =$$

1. Can you carry out the following instructions with regard to a number line?

1.1  $3 + 4$

1.2  $8 - 12$

2. The temperature in Bloemfontein is  $4^\circ\text{C}$ . It drops by  $8^\circ\text{C}$ . What is the temperature now?

3. Calculate the following:

3.1:  $-5 - 18$

3.2:  $15 - 8 - 17 + 5$

3.3:  $-30 + 7 - 4$

3.4:  $-8 + (-5) + (+7)$

4. Can you think of a way to do 3.2; 3.3 and 3.4?

(A short cut?)

How would you do the following?

- Subtract - 5 from 3

Decide which number has to come first:  $3 - (-5)$

remember the rule – multiply the two signs next to each other.

$$(-) \times (-) \rightarrow (+)$$

- Thus:  $3 + 5 = 8$  (You can see how easy it is)

5. Now calculate the following:

5.1:  $-9 - (-6)$

5.2:  $-18 + (-13) - (-7)$

5.3:  $20 - (25 + 50)$

5.4:  $10 - (16 - 18)$

6. Calculate the difference between -31 and -17

7. Replace  $\_\_\_$  by a  $(+)$  or  $(-)$  to make the following statements true:

7.1:  $-6 \_\_\_ (-3) = -9$

7.2:  $5 \_\_\_ (-5) = 10$

#### HOMEWORK ASSIGNMENT 1

1. Calculate each of the following:

1.1:  $13 - 18 + 4 - 17$

1.2:  $-9 - (-8) + (-16)$

1.3:  $-(-16)^2 + (-3)^2$

1.4:  $(-13)^2 - (-13)$

1.5:  $[a + (-b)] + b$

1.6:  $[a + (-b)] + (-a)$

1.7:  $(-b) + [(-b) + a]$

1.8:  $(-y)^2 - (-x)^2 - (-x^2)$

2. By doing a calculation in each case, say whether the following is true or false.

2.1:  $-(-x) = x$

2.2:  $-(x + y) = -x - (-y)$

2.3:  $y + z = z - (-y)$

2.4:  $-(x - y) = -x + y$

3. Calculate the value of  $a$  to make each of the following true.

3.1:  $-5 + a = -7$

3.2:  $a + (-5) = 7$

3.3:  $-6 + a = -9$

3.4:  $18 + a = 10$

4. Your financial transactions for the past two months are as follows:

Holiday work: R 615 Expenses: Stationery: R 46

Petrol consumption: R 480 Personal expenses: R 199

Will you have a profit or a loss for the past period?

Show how you calculated this.

Assessment

Assessment of my- self:		by myself:		Assessment by Teacher:
<i>continued on next page</i>				



use in- ter- val no- ta- tion cor- rectly; (Lo 1.2.1);											Communication		
use the prop- er- ties of 0 and 1; and (Lo 1.2.1);											Problem solv- ing		
add and sub- tract in- te- gers. (Lo 17).											Independence		

Table 1.46

[U+F04A] *good* [U+F04B] *average* [U+F04C] *not so good*

Comments by the learner:			My plan of action:			My marks:		
I am very satisfied with the standard of my work.			<		Date:			
I am satisfied with the steady progress I have made.					Out of:			
I have worked hard, but my achievement is not satisfactory.					Learner:			
I did not give my best.			>					

Table 1.47

Comments by parents:		Comments by teacher:
Signature: Date:		Signature: Date:

Table 1.48

## CLASS ASSIGNMENT 3

- Step by step, discover more about ... multiplying and dividing integers.
- Do you still remember the sequence of operations? Write them down:

(You must always do these four in sequence in any sum)

Look at:  $+4 \times (-3) = -12$

- Step 1: first multiply the signs:  $(+) \times (-) \rightarrow (-)$

- Step 2: now multiply the numbers:  $4 \times 3 = 12$

What about  $-12 \div (+4) = -3$

- Step 1: first divide (same as for multiplying) the two signs  $(-) \div (+) \rightarrow (-)$
- Step 2: now do  $12 \div 4 = 3$  OR  $12/4$

1. Calculate the following:

- 1.1:  $-7 \times (-3) \times (-2)$
- 1.2:  $-18 \times (-2) + (-17) \times (-2)$
- 1.3:  $-5 \times (-7)$
- 1.4:  $3 \times (8 - 19) + 6$
- 1.5:  $3 \times (-8) \times (19 + 6)$
- 1.6:  $(-2)^3$
- 1.7:  $(-4)^3 - (-2)^2$
- 1.8:  $(15 - 9)^2$
- 1.9:  $(9 - 15)^2$
- 1.10:  $-2 (-3)^2$
- 1.11:  $\frac{-5-6}{3}$
- 1.12:  $\frac{-6(-4)}{-12-(-2)}$
- 1.13:  $-6 \times \frac{(-5)}{-7}$
- 1.14:  $\frac{53}{-25}$
- 1.15:  $-50 \div ? = -10$

2. Calculate  $p$  if  $a = -2$  and  $b = 3$

2.1  $p = a \times b \div a^2$

2.2  $p = 4ab \div ab$

HOMEWORK ASSIGNMENT 2 (*Mixed examples*)

1. Simplify:

1.1  $(13)^2 - (-13)^2 - 13^2$

1.2  $(7 - 8)^2 - (8 - 7)^2 - 8^2 - 7^2$

1.3  $(3 + 2)3 - 33 - 22$

2. Divide -147 by -21 and then subtract -55 from the quotient.

3. Divide the product of 17 and -15 by -7

4. Subtract -58 from the sum of -88 and 7.

5. Subtract the product of -5 and 17 from -7

6. Calculate  $p$  in each case:

6.1:  $20 + p = -40$

6.2:  $-8 + (-p) = 0$

6.3:  $-10 + (-17) + p = -20$

6.4:  $2p - (-6) = -4$

7. If  $-a = -4$ , then  $a = \dots$

8. If  $x = 3$ , then  $-(-x) = \dots$

9.  $x \in \{-3; -2; -1; 0; 1; 2; 3; 4; 5\}$ ; Select from the set of integers and tabulate all the possible answers.

9.1:  $-2 < x < 4$

9.2:  $x > 1$

9.3:  $x < 0$

Assessment



Assessment of myself:		by myself:				Assessment by Teacher:							
I can...		[U+F04A]	[U+F04B]	[U+F04C]	1	2	3	4		Critical Outcomes	2	3	4
multiply integers; (Lo 1.2.5);										Critical and creative thinking			
divide integers by integers; (Lo 1.2.5);										Collaborating			
do a mixture of examples ( +; - ; × and [U+F0B8] ); and (Lo 1.2.1; 1.2.5);										Organising en man-aging			
calculate the value of unknown ones. (Lo 2.5).										Processing of in-for-mation			

*continued on next page*



I did not give my best.			>					
-------------------------	--	--	---	--	--	--	--	--

Table 1.50

Comments by parents:		Comments by teacher:
Signature: <i>Date:</i>		Signature: <i>Date:</i>

Table 1.51

Tutorial 1: (Integers)

Total: 40

1. Complete:

n	2	5			-20
$7n - 5$	9		-58	65	

Table 1.52

[4]

2. Select from the set of integers:

2.1  $4n + 3 > 30$   $n \in \{ \}$  [2]

2.2  $\frac{n}{2} - 1 < 2$   $n \in \{ \}$  [2]

3. Represent the following graphically:

3.1  $\{ x / x \in \mathbb{Z}, -3 < x < 5 \}$  [2]

3.2  $\{ x / x \in \mathbb{Z}, x < 1 \}$  [2]

4. Calculate each of the following:

4.1:  $[-(-2)^2]^3$  [2]

4.2:  $-8 + (-9) - (-8) + 9$  [2]

4.3:  $15 + 8 \times (-5) + 3 \times (-4)$  [3]

4.4:  $\frac{6}{11} \div (-24)$  [2]

4.5:  $(-0,3)^2 \times (-0,4)$  [2]

4.6:  $-(-1)^2$  [2]

4.7: What should be added to -17 to give + 70? [2]

4.8:  $-0,75a^2 \times 0,3a^3$  [3]

4.9:  $\left( \frac{-12^6 b^4}{4a^5 b} \right)$  [3]

5. If  $a = -2$  and  $b = -1$ , calculate:

5.1:  $(3b - 3a)^2$  [2]

5.2:  $-3a^3 + 3b^2$  [3]

5.3:  $3a^2$  [2]

Integers**Tutorial**

I demonstrate knowledge and understanding of:		Learning outcomes		0000	000	00	0
1.	the ordering of integers;	1.2.1 ; 1.2.2					
2.	graphic representation of integers;	1.2.1; 1.2.2					
3.	numbers in set builder notation;	1.2.1 ; 1.2.2					
4.	representing numbers in interval notation;	1.2.1 ; 1.2.2					
5.	calculating and subtracting integers;	1.2.1; 1.2.2 ; 1.7					
6.	multiply integers with one another;	1.2.1; 1.2.2 ; 1.7					
7.	dividing integers with one another.	1.2.1; 1.2.2; 1.2.5; 1.7					
8.							
9.							
10.							
11.							
12.							
13.							
14.							

Table 1.53

The learner's ...	1	2	3	4
work is...	Not done..	Partially done.	Mostly complete.	Complete.
layout of the work is...	Not understandable.	Difficult to follow.	Sometimes easy to follow.	Easy to follow.
accuracy of calculations...	Are mathematically incorrect.	Contain major errors.	Contain minor errors.	Are correct.

Table 1.54

	My BEST marks:			Comments by teacher:		
<i>Date:</i>						
Out of:						
<b>Learner:</b>						
				Signature: <i>Date:</i>		

Table 1.55

Parent signature: *Date:*  
 Test 1: (Integers)

- Total: 40
1. Simplify:
- 1.1:  $834 n^4 \times 0$  [1]
- 1.2:  $(-1)^{10}$  [1]
- 1.3:  $-8m^6 \div 2m^3$  [2]
- 1.4:  $(-2c^4d^3)^3$  [2]
- 1.5:  $2p^3qx(-3pq^3) \times (-5pq^2)$  [3]
- 1.6:  $-6a^8 \div (-2a^2) + 4a^2 \times 3a^4$  [3]
- 1.7:  $(-2) + (+3) - (-4) - (-1)$  [2]
- 1.8:  $-6a^3 + (-2a^2b) + (-4a^3) - (+5b^2a)$  [3]
- 1.9:  $\frac{-3k^6m^3}{-9k^2m^{12}}$  [3]
- 1.10:  $-3ab(ab-2b) - (-4ab)$  [3]
- 1.11:  $\frac{12a^6-4a^2}{-4a^2}$  [3]
2. If  $A = 2p - 3q - 4r$  and  $B = -2p + 3r - 4q$   
Determine:  $-2A - 3B$
- [4]
3. Subtract the product of  $-3a + 12ab$  and  $-6(ab)^2$  from  $5a^3b - 10a^3b^3$
- [4]
4. Calculate the quotient of  $-2(a + b)$  and  $-3a$
- [3]
5. Write in set builder notation:

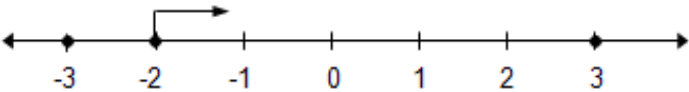


Figure 1.12

- [2]
6. **Bonus question**
- Prove that the product of three consecutive integers plus one will always be a perfect square.
- [2]
- Enrichment exercise for the quick worker
- (Learning unit 1)
1. If  $\frac{1}{x-\frac{1}{3}} = \frac{1}{2}$ , then x is equal to ....
2. The figure shows a magic square in which the sum of the numbers in any row, column or diagonal is equal. The value of n is...

8		
9		
4	n	

Table 1.56

3. A train passes completely through a tunnel in 5 minutes. A second train, twice as long, passes through the tunnel in six minutes. If both trains were travelling at 24 km/h determine the length of the tunnel.

4. A clock loses exactly 4 minutes every hour. At 06:00 it is set correctly. What will the correct time be when the clock shows 15:48 for the first time?

5. The last digit of the number  $3^{1993}$  is ...

6. You are travelling along a road at a constant speed of 105 km per hour, and you notice that you pass telephone pylons at the side of the road at regular intervals. If it takes 72 seconds to travel from the first pylon to the fifteenth, then the distance in metres between two successive pylons is ...

### 1.7.1.6 Memorandum

#### CLASS ASSIGNMENT 1

1. "Less than 0" not positive
- 2.



Figure 1.13

---

1. temperatures; bank balances; etc.
4. Numbers with no fractions or decimals added to it e.g. 2 not  $2\frac{1}{2}$  or 2,5
5.  $\mathbb{Z}$
- 6.
- 6.1.1
- 6.1.2
- 6.1.3
- $-1 \leq x < 2$ ;  $x \in \mathbb{Z}$
- $x \geq 3$ ;  $x \in \mathbb{Z}$
- $-2 < x < 2$ ;  $x \in \mathbb{Z}$

#### CLASS ASSIGNMENT 2

- 1.1
2.  $4^0 - 8^0 = -4^0 C$
- $:-13$
- $:-5$
- $:-27$
- $:-8 - 5 + 7 = -6$
4. Add all (+) numbers; Add all (-) numbers; Subtract them from each other.
- $:-9 + 6 = -3$
- $:-18 - 13 + 7 = -14$

- $:20 - 75 = -55$
- $:10 - (-2) = 10 + 2 = 12$

1.  $:-31 - (-17) = -31 + 17 = -14$

7.1  $:-6 + (-3) = -9$

7.2  $:5 - (-5) = 10$

## HOMEWORK ASSIGNMENT 2

- $:13 - 18 + 4 - 17 = -18$
- $:-9 - (-8) + (-16)$

$-9 + 8 - 16 = -17$

- $:-(-16)^2 + (-3)^2$

$= -256 + 9$   
 $= -247$

- $:(-13)^2 - (-13)$

$= 169 + 13$   
 $= 179$

1.5  $:a - b + b = a$

1.6  $:a - b - a = -b$

1.7  $:-b - b + a = -2b$

1.8  $:y^2 - x^2 - x^2 = y^2$

- True
- $:-x - y \neq -x + y$  False
- $:y + z = z + y$  True
- $:-x + y = -x + y$  True

3.1  $:a = -2$

3.2  $:a = 12$

3.3  $:a = -3$

3.4  $:-8 = a$

4.  $R615 - R(46 + 480 + 199)$

$= R615 - R725$

$= R110$  (-) Loss

## CLASS ASSIGNMENT 3

1. ( )

2. of

3.  $x$  or  $\div$  : from left to right

4.  $+$  or  $-$  : from left to right

- $:-42$
- $:36 + 34 = 70$
- $:35$
- $:3 \times (-1) + 6 = -3 + 6 = 3$
- $:-24 \times 25 = -600$
- $:(-2)^3 = -8$
- $:(-64) - (+2) = -64 - 2$

$$= -66$$

- $:(15 - 9)^2 = (6)^2 = 36$
- $:(-6)^2 = 36$
- $:-2(9) = -18$
- $\frac{-11}{3} = -3\frac{1}{3}$
- $\frac{-24}{-12+2} = \frac{-24}{-10} = -2,4$
- $-6 \times \frac{5}{7} = \frac{-30}{7} = -4\frac{2}{7}$
- $\frac{53}{-25} = -2\frac{3}{25}$  or  $-2,12$

- $:-50 \div 5 = -10$

$$\begin{aligned} 2. \quad p &= (-2) \times (3) \div (-2)^2 \\ &= -6 \div 4 \\ &= \frac{-6}{4} = -1\frac{1}{2} / -1,5 \end{aligned}$$

- $p = 4(-2)(3) \div (-2)(3)$

$$\begin{aligned} &= -24 \div (-6) \\ &= 4 \end{aligned}$$

#### HOMEWORK ASSIGNMENT 2

- $(13)^2 - (-13)^2 - 13^2$

$$= 169 - 169 - 169 = -169$$

- $(7 - 8)^2 - (8 - 7)^2 - 8^2 - 7^2$

$$\begin{aligned} &= (-1)^2 - (1)^2 - 64 - 49 \\ &= +1 - 1 - 64 - 49 \\ &= -113 \end{aligned}$$

- $(5)3 - 33 - 22$

$$= 15 - 55$$

$$= -40$$

$$2. \quad \frac{-147}{-21} - (-55)$$

$$= 7 + 55$$

$$= 62$$

$$3. \quad 17 \times (-15) \div (-7)$$

$$= -255 \div (-7)$$

$$= 36,4$$

$$4. \quad (-88 + 7) - (-58)$$

$$= -81 + 58$$

$$= -23$$

$$5. \quad -7 - (-5 \times 17)$$

$$= -7 + 85$$

$$= 78$$

- $:p = -60$
- $:p = -8$
- $:p = 7$
- $:2p + 6 = -4$



$$p = -5$$

$$7. a = 4$$

$$8. -(-3) = 3$$

- $\{-1; 0; 1; 2; 3\}$
- $\{2; 3; 4; 5\}$
- $\{-1; -2; -3\}$

### 1.7.1.6.1 TUTORIAL 1

$$1. :30; \frac{-53}{7} = -7,6 \sqrt{}; 10; -145 \sqrt{} \\ 2.1 : n = \frac{27}{4} = 6 \frac{3}{4} n > 6 \frac{3}{4} n \{7; 8; 9; . . . \} \sqrt{\sqrt{}}$$

- $:\{5; 4; 3; 2; 1\} \sqrt{} \sqrt{}$
- $\sqrt{\sqrt{}}$
- $\sqrt{\sqrt{}}$

- $:[-(4)]^3 \sqrt{} = -64 \sqrt{}$
- $:-8 - 9 + 8 + 9 \sqrt{} = 0 \sqrt{}$
- $:15 + (-40) \sqrt{} + (-12) \sqrt{} = -37 \sqrt{}$
- $: \frac{6^1}{11} \times \frac{1}{-244} \sqrt{}$

$$= -\frac{1}{44} \sqrt{}$$

- $:(0,09) \sqrt{} \times (-0,04) = -0,0036 \sqrt{}$
- $:-1 \sqrt{\sqrt{}}$
- $:87 \sqrt{\sqrt{}}$

$$\sqrt{} \sqrt{} \sqrt{}$$

- $:-0,225a^5$
- $\left(\frac{-12^3 a^{ab} b^{4b^3}}{4a^5 b}\right)$

$$\sqrt{} \sqrt{} \sqrt{} \\ = 9a^2 b$$

- $:[3(-1) - 3\{-2\}]^2 \sqrt{}$

$$= [-3 + 6]^2 \\ = 9 \sqrt{}$$

- $:-3(-2)^3 + 3(-1)^2 \sqrt{}$

$$= -3(-8) + 3(1) \sqrt{} \\ = 24 + 3$$

$$= 27 \sqrt{} \\ 5.3 : 3(-2)^2 \sqrt{} \\ = 3(4) \\ = 12 \sqrt{}$$

TEST (INTEGER)

- $:0 \sqrt{}$

- $:1 \sqrt{\quad}$
- $: \frac{-8^4 M^{6^3}}{2M^3} - 4M^3 \sqrt{\quad}$

 $\sqrt{\quad} \sqrt{\quad}$ 

- $:-8c^{12}d^9$

 $\sqrt{\quad} \sqrt{\quad} \sqrt{\quad}$ 

- $:30p^5q^6$
- $: \frac{-6^3 a^{8^6}}{-2a^2} + 12a^6$

 $\sqrt{\quad} \sqrt{\quad} \sqrt{\quad}$   
 $= 3a^6 + 12a^6 = 15a^6$ 

- $:-2 + 3 + 4 + 1 \sqrt{\quad} = 6 \sqrt{\quad}$
- $:-6a^3 - 2a^2b - 4a^3 - 5ab^2 \sqrt{\quad}$

 $= -10a^3 - 2a^2b - 5ab^2 \sqrt{\quad}$ 
 $\sqrt{\quad} \sqrt{\quad} \sqrt{\quad} 1.9 : \frac{k^4}{3M^9}$   
 $\sqrt{\quad} \sqrt{\quad} \sqrt{\quad}$ 

- $:-3a^2b^2 + 6ab^2 + 4ab$

 $\sqrt{\quad} \sqrt{\quad} \sqrt{\quad}$ 

- $:-3a^4 + 1 \left[ \frac{12a^6}{-4a^2} - \frac{4a^2}{-4a^2} \right]$

1.  $:-2(2p - 3q - 4r) - 3(-2p + 3r - 4q) \sqrt{\quad}$

$$\begin{aligned}
 &= -4p + 6q + 8r + 6p - 9r + 12q \sqrt{\quad} \\
 &= 2p + 18q - r \sqrt{\quad} \\
 &3. : 5a^3b - 10a^3b^3 - [-6a^2b^2(-3a + 12ab)] \sqrt{\quad} \\
 &5a^3b - 10a^3b^3 - [18a^3b^2 - 72a^3b^3] \sqrt{\quad} \\
 &5a^3b - 10a^3b^3 - 18a^3b^2 + 72a^3b^3 \sqrt{\quad} \\
 &5a^3b - 18a^3b^2 + 62a^3b^3 \sqrt{\quad} \\
 &4. \frac{-2(a+b)}{-3a} = \frac{-2a-2b}{-3a} \sqrt{\quad} \\
 &= \frac{-2a}{-3a} - \frac{2b}{-3a} \\
 &= \frac{2}{3} + \frac{2b}{3a} \\
 &\sqrt{\quad} \sqrt{\quad} \\
 &\sqrt{\quad} \sqrt{\quad} \\
 &5. \{x / -2 \leq x \leq 3; x \in \mathbb{R}\} \\
 &6. x(x+1)(x+2) + 1 \\
 &= (x^2 + x)(x+2) + 1 \\
 &= x^3 + 2x^2 + x^2 + 2x + 1 \\
 &= x^3 + 3x^2 + 2x + 1 \\
 &2(3)(4) + 1 = 25 \\
 &4(5)(6) + 1 = 35 \text{ False} \\
 &5(6)(7) + 1 = 211 \text{ False}
 \end{aligned}$$

### 1.7.1.6.2 ENRICHMENT EXERCISE

$$\begin{aligned}
 1. \quad & \frac{1}{\frac{3x-1}{3}} \\
 &= \frac{1}{2} \frac{2}{1} = \frac{3x-1}{3} \\
 6 &= 3x + 1 \\
 7 &= 3x \\
 (2 \frac{1}{3}) \frac{7}{3} &= x
 \end{aligned}$$

## 1.7.2 Equations<sup>8</sup>

### 1.7.2.1 MATHEMATICS

#### 1.7.2.2 Grade 8

### 1.7.2.3 INTEGERS, EQUATIONS AND GEOMETRY

#### 1.7.2.4 Module 8

### 1.7.2.5 EQUATIONS

#### CLASS ASSIGNMENT 1

- Step by step, discover more about... what an equation is and how to solve it....

1. What do you understand by the term “equation” ?
2. What do you understand by the term “inspection” ?
3. What does it mean if we say: “solve the equation” ?
4. Give an example of an equation.
5. Now solve the equation in (4).  
(Get your teacher to help you).
6. Solve each of the following equations by inspection.(i.e. determine the value of a)
  - 6.1  $1 - a = 7$
  - 6.2  $5a = 50$
  - 6.3  $a/7 = 6$
  - 6.4  $66/a = 6$
  - 6.5  $-a/2 = 15$
  - 6.6  $5a - 4 = 26$
7. How do you solve an equation if not by inspection?
  - 7.1 Here are a few tips:

**Step 1: Identify all the unknowns (in this case “ a ”) and get it on the left-hand side of the “=” sign.**

Step 2: Identify all the constants and get it on the right-hand side of the “=” sign.

Step 3: Add up similar terms.

Step 4: Identify unknown alone (by multiplying or dividing with coefficient of unknown)

Step 1:

**+5 a (must do the same on the other side) +5 a (to get rid of “ a ’s”)**

$$2a + 6 = -5a - 9$$

We get the following:

$$2a + 5a + 6 = -9$$

Step 2:

**-6 (to get rid of +6) -6 (must do the same on the other side)**

$$2a + 5a + 6 = -9$$

---

<sup>8</sup>This content is available online at <<http://cnx.org/content/m31112/1.1/>>.

We get the following:

$$2a + 5a = -9 - 6$$

Step 3: **Add up the similar terms**

$$7a = -15$$

Step 4: **Get “a” alone:  $\div 7$  left and right of the “=” sign**

$$\frac{7a}{7} = \frac{-15}{7}$$

$$a = -2\frac{1}{7}$$

7.2 What about ? :

$$a/3 = 7$$

$$a/3 = 7/1 \text{ (multiply cross-wise)}$$

$$a \times 1 = 7 \times 3$$

$$a = 21$$

7.3 Remember that if there are brackets, the brackets must first be removed.e.g.

$$2(2a - 6) + 7 = 9a - 3(a - 2)$$

$$4a - 12 + 7 = 9a - 3a + 6$$

$$4a - 3a - 9a = 6 - 7 + 12$$

$$-8a = 11$$

$$a = 11/-8$$

$$a = -1\frac{3}{8}$$

8. Solve the following equations:

$$8.1: 5 - 3(4 - a) = 5(a + 1) + 2$$

$$8.2: 2a - 24 = 3a$$

$$8.3: a/4 + 5 = 10 \text{ (tip: fractions and cross-wise multiplication)}$$

$$8.4: 5a - 3a - 7 = 9$$

$$8.5: -8a = 72$$

$$8.6: 3^2 + 3a + 3 = 2^3 + 4(-2a)$$

$$8.7: -12/a = -24$$

$$8.8: 5(2a + 1) = 4(2a + 3)$$

$$8.9: -2(3a - 3) = 6a + 24$$

8.10: Write down any equation of your own and solve it.

Conditions: it must contain brackets, fractions and negative numbers.

CLASS ASSIGNMENT 2

- **Step by step, discover more about ... the solving of word problems, which can become a feast if you can present them as equations ...**

To share in this feast, you need the following basic knowledge: ...

1. Words like ... more (means +), less (means -) and times (means  $\times$ ), consecutive numbers (first number: x, second number:  $x + 1$  and third number:  $x + 2$ )

1.1 How would you represent the following consecutive even numbers?

First number: ..... Second number: ..... Third number: .....

1.2 How would you represent a two-digit number if the digits are unknown?

- How would you write 24 in extended notation:  $(2 \times 10) + (4 \times 1)$
- If you can say that the tens digit is half the ones digit, you would do the following:

tens ones

a  $2a$  (tens digit is half the ones digit)

Thus:  $(a \times 10) + (2a \times 1) = 10a + 2a = 12a$  ( $12a$  is the number)

2. Your first question must always be: “About which one do I know nothing?”- This is then represented by e.g. x and the other unknowns in terms of x.

3. Write down an equation.

4. Solve the equation.
5. Answer the question.

Let us look at a few examples:

Example 1:

*Problem:* the length of a rectangle is 5 cm more than its width.

*Solution:*

- 1) Draw a rectangle
- 2) Ask yourself: about which one, length or width, do I know nothing? In this case it is width =  $x$  cm

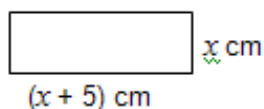


Figure 1.14

- 3) Now express the length in terms of  $x$  : in this case:  $(x + 5)$  (remember 5 more: i.e.  $x + 5$ )
- 4) The question can also say that the perimeter is 80 cm, so calculate the length and width of the rectangle. (You can represent the data as an equation.)

Do this now:

- 5) Solve the equation and answer the question in (4)

Example 2:

*Problem:* A mother is four times as old as her daughter. Their joint age is 60, how old is each one?

*Solution:*

- 1) Ask yourself: about which one do I know nothing? Let this be  $x$ .
- 2) Represent your thoughts thus far:

**Mother**  $4x$

**Daughter**  $x$

- 3) Represent the data as an equation, solve the equation and answer the question.

Example 3:

The problem about ages is always difficult, but do it step by step and write down the plan of your thoughts, and it becomes very easy....

*Problem:* Milandre is 30 years older than Filandre. In 15 years' time Milandre will be twice as old as Filandre. How old are they now?

*Solution :*

- 1) Begin with a plan and write it down:
- 2) Ask yourself: About which do I know nothing? Make this  $x$ .

age: now

Milandre  $x + 30$

Filandre  $x$

**age: in 15 years' time:** (i.e.  $+ 15$ )

$(x + 30) + 15$

$x + 15$

- 3) Now comes the most difficult part: in 15 years' time Milandre will be twice as old as Filandre. As Milandre will be twice as old as Filandre, you will have to multiply Filandre's age (in the column in 15 years' time) by 2 so that you can get an equation (i.e. left-hand side = right-hand side)

- 4) Write down the equation below, solve it and answer the question.

See if you can do it on your own. Remember that you must write down your plan of thinking.

Here they are.....

1. The sum of two numbers is 15. Write down the two numbers in terms of  $x$ .

2. 140 people attend the Steve Hofmeyer concert.

The following tickets are available:

Children: R 20

Adults: R 45

If the entrance money amounted to R5 580, calculate how many adults and how many children were present.

#### HOMEWORK ASSIGNMENTS 1 and 2

1. Given:  $a \in \{-4; -3; -2; -1; 1; 2; 3\}$  Select your answer from the above set in each case.

1.1  $-3a + 20 = 23$

1.2  $8a = -32$

2. The value of  $x$  is given in each case. Test the correctness of each equation.

2.1  $8x - 2(x - 5) = 28$   $x = 3$

2.2  $5x - 10 = 10$   $x - 10 \in R$

3. Solve the following equations. Show all your calculations.

3.1  $1/z = 1/18$   $z = ?$

3.2  $1 - 5z = 11$

3.2.1: where  $z \in N$

3.2.2: where  $z \in Q$

3.3:  $z + 3[z + 2(z - 6)] = 45$

3.4:  $4(6z - 8) - 2(z + 7) = 37$

3.5:  $z - 5(z - 8) = -48$

4. Write each of the following as an algebraic equation and solve it.

4.1 Six times a number, reduced by 8, is equal to 55. Calculate the number.

- A negative number is nine times another number. The sum of the two numbers is

-64. Determine the two numbers.

4.3 The sum of three consecutive negative integers is -90. Determine the three negative numbers.

4.4 Jessica buys three times more oranges than bananas. If the oranges cost 45c each and the bananas 18c each, how many of each did she buy if the total cost was R18,36?

4.5 Cameron is eight years older than Liam. Six years ago Cameron was three times as old as Liam. How old are they now?

4.6 You have bought stamps from the post office. These include stamps for R1,20 each and for R2,40 each. If the total value of the stamps is R58,80, determine how many of each type of stamp you bought.

4.7 Divide a piece of hosepipe of 18 m in two, so that one piece is 550 mm longer than twice the other piece. Determine the length of each piece of hosepipe.

4.8 18 women and 25 girls have a total mass of 3 792 kg. The girls all have the same mass and each woman is three times heavier than a girl. Determine the mass of a woman and a girl.

4.9 The ones digit of a two-digit number is double the tens digit of the number. If the two digits are swapped around, you get a number that is 36 higher than the original number. Calculate the original two-digit number.

4.10 There are 25 more learners in grade 10 than in grade 9 and 32 more learners in grade 8 than in grade 9. If the total number of learners from grade 8 to grade 10 is 732, calculate how many learners there are in each grade.

#### Assessment



remove brackets and then solve an equation; (Lo 2.5; 2.8.4);										Organising en man- ag- ing			
solve comparisons containing fractions; (Lo 1.8; 2.5)										Processing of in- for- ma- tion			
write word problems in algebraic equations; (Lo 2.8.6);										Communication			
<i>continued on next page</i>													





I did not give my best.			>					
-------------------------	--	--	---	--	--	--	--	--

Table 1.58

Comments by parents:		Comments by teacher:
Signature: <i>Date:</i>		Signature: <i>Date:</i>

Table 1.59

## Tutorial 2: (Equations)

Total: 50

1. Given:  $5x = 1$ 

1.1 Does the above represent an equation? Give a reason for your answer.

[2]

1.2 Determine now the possible answer for  $x$  by inspection.

[1]

2. Determine the value for  $a$  in each of the following ( by INSPECTION). Write down the answers only

2.1:  $a + 7 = 19$

2.2:  $5a - 7 = 28$

2.3:  $6a - 7 = 3a$

2.4:  $\frac{4a}{3} + 5 = 9$

2.5:  $\frac{4}{3}a + 5\frac{2}{3} = 6$

[ $5 \times 2 = 10$ ]

3. Determine  $p$  in each of the following using substitution. Round of your answers to the nearest 3 decimals.

3.1:  $f = 4(2b - p)$ ,  $f = 32$  and  $b = 9$

[3]

3.2:  $f = p/r$ ,  $f = 45,67$  and  $r = 21,3$

[3]

4. Determine the value for  $a$  in each of the following. Show all your calculations.

4.1:  $7a + \frac{a}{3} = 5(2 + 3)$

[3]

4.2:  $a(4a - 3) = (-2a)^2$

[3]

4.3:  $-4(a - 2) = 3(a - 4)$

[3]

4.4:  $5(a + 3) + 4a + 5 = 2(a - 7)$

[4]

4.5:  $5a = -2(a - 3)$

[3]

5. Write as algebraic equations and solve.

5.1 Nine times a certain number is 28 more than five times the number. What is the number?

[2]

5.2 A rectangle, of which the perimeter is 108 cm, has a length which is four more than the breadth. Determine:



solve elementary comparisons by means of inspection; (Lo 1.8 ; 2.5);											Collaborating		
solve any comparison despite the brackets; (Lo 1.8 ; 2.5);											Organising en man- ag- ing		
continued on next page													



											Problem solv- ing			
											Indep	endence		

Table 1.60

[U+F04A] *good* [U+F04B] *average* [U+F04C] *not so good*

Comments by the learner:			My plan of action:			My marks:		
I am very satisfied with the standard of my work.			<		<i>Date:</i>			
I am satisfied with the steady progress I have made.					Out of:			
I have worked hard, but my achieve- ment is not sat- isfactory.					<b>Learner:</b>			
<i>continued on next page</i>								

I did not give my best.			>					
-------------------------	--	--	---	--	--	--	--	--

Table 1.61

Comments by parents:		Comments by teacher:
Signature: <i>Date:</i>		Signature: <i>Date:</i>

Table 1.62

Test 1: (Equations)

Total: 45

1. Solve for x:

1.1:  $x + 5 = 39$  [2]

1.2:  $7 - 3x = 1$  [2]

1.3:  $2(x + 5) = 18$  [3]

1.4:  $8 = 40 - 2x$  [2]

1.6:  $2(x - 3) - (x + 1) = 5x - 4$  [4]

1.7:  $3x + 6 = 15$  [2]

1.8:  $\frac{x}{2} = 4$  [2]

1.9:  $2(3x + 24) = 114$  [3]

1.10:  $10x + 9 = 7x + 30$  [3]

1.11:  $\frac{1}{3}(3x - 6) - 2(x + 1\frac{1}{2}) = 7$  [4]

[27]

2. Solve the following word problems:

2.1 If 5 is subtracted from a certain number and the answer is divided by 3, the answer is 4. Determine the number.

[3]

2.2 The sum of three consecutive even numbers is 66. Determine the numbers.

[3]

2.3 The length of a rectangle is 5,5 cm longer than its breadth. If the perimeter of the rectangle is 27 cm, determine the breadth.

[4]

2.4 Jonte's age is five times the age of his daughter. If the sum of their ages is 60 years, how old is his daughter?

[4]

2.5 Gareth is 5 times as old as his son. In 5 years time he will be 3 times as old as his son. How old is his son now?

[4]

3. Bonus

Given:  $\frac{1}{2}a + 2a = 7$

Determine the value of  $\frac{1}{4a^2} + 4a^2$

[3]

Enrichment exercise for the quick worker

(Learning unit 2)

1. If the product  $2^{12} \times 5^8$  is expanded, how many digits will the answer consist of?

2.  $6^2 = 36$ . How many other positive single-digit numbers are there whose squares also end with the same digit as the number you are squaring?

1. The three digit number 2A3 is added to 326 and gives 5T9. If 5T9 is divisible by 9, then  $A + T$  is equal to .....

4. If from a four digit number starting with 199, you subtract a four-digit number starting with 34, then your largest possible answer is ...

5. If you write 1,2,3,6 in every possible order to form 4-digit numbers, how many of these numbers will be divisible by 4?

6. Let  $n$  be any natural number. If the tens digit of  $n^2$  is equal to 3, what is the last digit of  $n^2$ .

7. The average of three integers is 86. If one number is 70, what is the average of the other two?

8. At ABSA Saretha exchanged a R10 and a R20 note for an equal number of 50 cent, 20 cent and 5 cent coins. How many coins did Saretha receive?

### 1.7.2.6 Memorandum

#### LEARNING UNIT 2

1. - 5. General

$$6.1 \ 1 - a = 7 \ a = -6$$

- $a = 10$
- $42 = a$
- $a = 11$
- $-30 = a$
- $a = 6$

$$\bullet \ 5 - 12 + 3a = 5a + 5 + 2$$

$$3a - 5a = 5 + 2 + 12 - 5$$

$$-2a = 14$$

$$a = -7$$

$$\bullet \ 2a - 3a = 24$$

$$-a = 24$$

$$\therefore a = -24$$

$$8.3 \ \frac{a}{4} = \frac{5}{1}a = 20$$

$$8.4 \ 2a = 16$$

$$a = 8$$

- $a = -9$
- $9 + 3a + 3 = 8 - 8a$

$$11a = -4$$

$$\therefore a = \frac{-4}{11} \left(-2 \frac{3}{8}\right)$$

$$8.7 \ \frac{-12}{1} = \frac{-24}{1} -24a = -12$$

$$a = \frac{1}{2}$$

$$\bullet \ 10a + 5 = 8a + 12$$

$$2a = 7$$

$$a = 3 \frac{1}{2}$$

$$8.9 \ -6a + 6 = 6a + 24$$

$$-12a = 18$$

$$a = \frac{-18}{12} \frac{-3}{2} \left(-1 \frac{1}{2}\right)$$



- Own choice

## CLASSWORK ASSIGNMENT 2

a. 20: 1. Number 1:  $x$

Number 2:  $15 - x$

2. Children:  $x$  20  $x$

Adults:  $(140 - x)$   $45(140 - x)$

$$20x + 45(140 - x) = 5\,580$$

$$20x + 6\,300 - 45x = 5\,580$$

$$-25x = -720$$

$$x = 28,8 \text{ 28 / 29}$$

$$\text{Adults: } 140 - 28 = 112$$

$$\text{or } 140 - 29 = 111$$

## HOMEWORK ASSIGNMENT 1 AND 2

- $-3a = 3$

$$a = -1$$

- $a = -4$

- $8x - 21x + 10 = 28$

$$8(3) - 2(3) + 10 = 28$$

$$1. -6 + 10 = 28 \checkmark$$

$$2.2 \ 5x - 10 = 10x - 10$$

$$5x - 10x = -10 + 10$$

$$-5x = 0$$

$$x = 0$$

$$x \ 1R \checkmark$$

$$3.1 \ \frac{1}{z} = \frac{1}{18}z = 18$$

$$3.2 \ 1 - 5z = 11$$

$$-5z = 10$$

$$z = -2$$

$$3.2.1 \text{ No solution}$$

$$3.2.2 \ z = -2$$

$$3.3 \ z + 3[z + 2z - 12] = 45$$

$$z + 3[3z - 12] = 45$$

$$z + 9z - 36 = 45$$

$$10z = 81$$

$$z = 8,1$$

$$3.4 \ 24z - 32 - 2z - 14 = 37$$

$$22z = 83$$

$$z \ 3,77$$

$$3.5 \ z - 5z + 40 = 48$$

$$-7z = -88$$

$$z = 22$$

- $6x - 8 = 55$

$$6x = 63$$

$$x = 10 \frac{1}{2} (10,5)$$

$$4.2x + 9x = -64$$

$$10x = -64$$

$$x = -6,4$$

$$4.3x + x + 1x + 2 = -90$$

$$3x = -93$$

$$x = -31 \quad -31; -30; 29$$

$$4.4 \text{ Oranges: } 3x \times 45 \quad 36$$

$$\text{Bananas: } x \times 18 \quad 12$$

$$18x + 135x = 1 \quad 836$$

$$153x = 1 \quad 836$$

$$x = 12$$

- Now -6

$$\text{Cameron: } x + 8 \mid 18 \mid x + 8 \quad -6$$

$$\text{Liam: } x \mid 10 \mid x - 6$$

$$3(x - 6) = x + 2$$

$$3x - 18 = x + 2$$

$$2x = 20$$

$$x = 10$$

$$\text{or } 4.6 \text{ Stamps: } R1,20 : x \quad 50 - x$$

$$R2,40 : 50 - x$$

$$120x + 240(50 - x) = 5 \quad 880 \quad 1,20(50 - x) + 2,40x = 58,8$$

$$\text{or } 120x + 12 \quad 000 - 240x = 5 \quad 880 \quad 60 - 1,20x + 2,40x = 58,8$$

$$-120x = -6 \quad 120 \quad 1,20x = 1,20$$

$$x = 51 \quad x = 1$$

$$R1,20 \quad 4$$

$$4.7 \text{ One part: } x$$

$$\text{Other part: } x + 550$$

$$x + 2(x + 550) = 18 \quad 000$$

$$x + 2x + 1 \quad 100 = 18 \quad 000$$

$$3x = 16 \quad 900$$

$$4.8 \text{ Mass}$$

$$3 \quad 792 \text{ kg Women: } 18 \quad 3 \quad x$$

$$\text{Girls: } 25 \quad x$$

$$25x + 3 \quad x \quad (18) = 3 \quad 792$$

$$25x + 54 \quad x = 3 \quad 792$$

$$79 \quad x = 3 \quad 792$$

$$x = 48$$

$$\text{Girls: } 48 \text{ kg each}$$

$$\text{Women: } 144 \text{ kg each}$$

$$\text{Number } 12 \quad x \quad 4.9 \text{ Units: } 2 \quad x \quad 8$$

$$\text{Tens } x \quad x \quad 10 \quad 4$$

$$\text{converted: } 21 \quad x$$

$$2 \quad x - 36 = 12 \quad x$$

$$9 \quad x = 36$$

$$x = 4$$

$$4.10 \text{ Gr. } 8: \quad x + 3^2 \quad 257$$

$$\text{Gr. } 9: \quad x \quad 225$$

$$\text{Gr. } 10: \quad x + 25 \quad 250$$

$$x + 32 + x + x + 25 = 732$$

$$3x = 675$$

$$x = 225$$

TUTORIAL 2

- Yes  $\checkmark$  = can work out the value for x

$$[5x = 5^0 \cdot x = 0]$$

- $x = 0 \checkmark$

- $a = 12 \checkmark \checkmark$

- $a = 7 \checkmark \checkmark$

- $a = \frac{7}{3} (2 \frac{1}{3}) \checkmark \checkmark$

- $a = 3 \checkmark \checkmark$

- $a = 4 \checkmark \checkmark$

- $32 = 4(2(9) - p) \checkmark$

$$32 = 4(18 - p)$$

$$8 = 18 - p \checkmark$$

$$p = 10 \checkmark$$

- $45,67 = \frac{p}{21,3} \checkmark$

$$p = 972,771 \checkmark$$

$$4.1 \frac{7a}{1} + \frac{a}{3} = 30$$

$$\frac{22a}{3} = \frac{30}{1} \checkmark$$

$$22a = 90 \checkmark$$

$$a = \frac{90}{22}$$

$$= 4 \frac{2}{11} = 4 \frac{1}{11} \checkmark$$

- $4a^2 - 3a = 4a^2 \checkmark \checkmark$

$$0 = 3a \checkmark$$

$$1. = a \checkmark$$

$$2. -4a + 8 = 3a - 12 \checkmark$$

$$-7a = -20 \checkmark$$

$$a = \frac{20}{7} = 2 \frac{6}{7} \text{ (or } 2,86) \checkmark$$

- $5a + 15 + 4a + 5 = 2a - 14 \checkmark$

$$7a = -34 \checkmark$$

$$a = -4,9 \checkmark$$

- $5a = -2a + 6 \checkmark$

$$7a = 6 \checkmark$$

$$a = \frac{6}{7} (0,86) \checkmark$$

- $9x - 28 = 5x \checkmark$

$$4x = 28$$

$$x = 7 \checkmark$$

$$5.2.1 \quad x + 4 \quad 2x + 2(x + 4) = 108 \checkmark$$

$$2x + 2x + 8 = 108$$

$$x \quad 4x = 100$$

$$x = 25 \checkmark$$

$$\checkmark \checkmark$$

$$\therefore 1 = 29 \text{ cmb} = 25 \text{ cm}$$

$$5.2.2 \quad A = 29 \times 25 \checkmark$$

$$= 725 \text{ cm}^2 \checkmark$$

$$6. \quad x + x + 2 + x + 4 + x + 6 = 112 \checkmark$$

$$4x = 112 - 12$$

$$4x = 100$$

$$x = 25 \checkmark$$

$$\therefore \text{Numbers : } 25; 27; 29; 31 \checkmark \checkmark$$

$$7. \quad \sqrt{6162} \quad 78 \checkmark$$

$$\therefore 6162 \div 78 = 79$$

$$\therefore 78; 79 \checkmark \checkmark$$

TEST 1

$$\bullet \quad x = 34$$

$$\bullet \quad -3x = 1$$

$$-3x = -6$$

$$\therefore x = 2$$

$$\bullet \quad 2x + 10 = 18$$

$$2x = 8$$

$$\therefore x = 4$$

$$\bullet \quad 2x = 40 - 8$$

$$2x = 32$$

$$\therefore x = 16$$

$$\bullet \quad 2x - 6 - x - 1 = 5x - 4$$

$$2x - x - 5x = -4 + 1 + 6$$

$$-4x = 3$$

$$x = \frac{-3}{4}$$

$$\bullet \quad 3x = 15 - 6$$

$$3x = 9$$

$$\therefore x = 3$$

$$1.7 \quad x = 4 \times 2 = 8$$

$$1.8 \quad 6x + 48 = 114$$

$$6x = 66$$

$$\therefore x = 11$$

$$\bullet \quad 10x - 7x = 30 - 9$$

$$3x = 21$$

$$\therefore x = 7$$

$$1.10x - 2 - 2x \cdot 3 = 7$$

$$-x = 7 + 3 + 2$$

$$-x = 12$$

$$\therefore x = -12$$

$$\bullet \left(\frac{x-5}{3}\right) = 4$$

$$x = (4 \times 3) + 5 \\ = 17$$

$$\bullet x + x \cdot 1 + x + 2 = 66$$

$$3x = 63$$

$$x = 21$$

$$\bullet 2x + 2(x + 5,5) = 27$$

$$2x + 2x + 11 = 27$$

$$4x = 16 \text{ x } 4 \text{ cm}$$

$$x = 4 \text{ x } 5,5 \text{ 9.5 cm}$$

$$2.4 \text{ Jonte: } 5x \cdot 50 \cdot 5x + x = 60$$

$$\text{Daughter: } x \cdot 10 \cdot 6x = 60$$

$$x = 10$$

$$2.5 \text{ Now } +5$$

$$\text{Gareth } 5x \cdot 5x + 5$$

$$\text{Son } xx + 5$$

$$\therefore \text{Gareth: } 25$$

$$\therefore \text{Son: } 5x + 5 = 3(x + 5)$$

$$5x + 5 = 3x + 15$$

$$2x = 10$$

$$x = 5$$

$$3. \left(\frac{1}{2a} + 2a^2 = 7^2\right)$$

$$\frac{1}{4a^2} + 2 + 4a^2 = 49$$

$$\frac{1}{4a^2} + 4a^2 = 47$$

### 1.7.3 Classifying, measuring and constructing angles<sup>9</sup>

#### 1.7.3.1 MATHEMATICS

#### 1.7.3.2 Grade 8

#### 1.7.3.3 INTEGERS, EQUATIONS AND GEOMETRY

#### 1.7.3.4 Module 9

#### 1.7.3.5 CLASSIFYING , MEASURING AND CONSTRUCTING ANGLES

1. How do you construct (draw) any size of angle?

To do this, you require the following:

compasses, protractor and ruler

General: construction of e.g.  $\overset{\ominus}{A}BC = 60^\circ$

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<sup>9</sup>This content is available online at <<http://cnx.org/content/m31541/1.1/>>.

- a) Start by drawing a line
- b) Make a mark on the line
- c) Place your protractor's mark in the middle of your mark
- d) Read from the  $0^\circ$  on the right-hand side to the desired degree



Figure 1.15

- e) Name your angle correctly [e.g.  $\angle A B C = 60^\circ$  or  $\angle B_1 = 60^\circ$ ]
2. How would you go about constructing an angle of, for example,  $330^\circ$  if the protractor can measure only angle sizes up to  $180^\circ$ ? Write down your plan below:
3. Construct the following angles and classify each and indicate the limits of degrees. E.g.  $60^\circ$  – **acute angle(classification)** —  $0^\circ < x < 90^\circ$  (**limits of  $^\circ$** ) Limits of  $^\circ$  are read as follows: x greater than  $0^\circ$  and smaller than  $90^\circ$

	Angle	Sketch	Classification(kind of angle)	Limits of $^\circ$
3.1	$\angle P Q R = 75^\circ$			
3.2	$\angle A B C = 125^\circ$			
3.3	$\angle H F G = 325^\circ$			
3.4	$\angle C D E = 180^\circ$			
3.5	$\angle K L M = 90^\circ$			
3.6	$\angle R S T = 360^\circ$			

Table 1.63

## HOMEWORK ASSIGNMENT 1

1. There are angles all around you....Determine the size of each of the angles indicated (with the aid of your protractor),write down the size of the angle concernedand classify it.



Figure 1.16

1.1

**Figure 1.17**

1.2

1.3

**Figure 1.18**

1.4

**Figure 1.19**

1.5

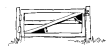
**Figure 1.20**

1.6

**Figure 1.21**

---

1.7

**Figure 1.22**

---

1.8

**Figure 1.23**

1.9

**Figure 1.24**

1.10

1.11

**Figure 1.25**

---



1.12



Figure 1.26

1.13



Figure 1.27

1.14



Figure 1.28

1.15

1.16



Figure 1.29

---

2. Construct the following angles by using your ruler and protractor.

2.1 A watch with an angle of  $45^\circ$  between the two numbers.

2.2 A sun bed with an angle of  $160^\circ$

2.3 A helicopter dropping at an angle of  $35^\circ$  with horizontal.

2.4 A reading lamp with angles  $115^\circ$  and  $65^\circ$ .

**1.7.3.6 Memorandum****CLASSWORK ASSIGNMENT 1**

2.  $360^0 - 330^0 = 30^0$

Construct  $30^0$ 

- Acute angle  $0^0 \angle Q \angle 90^0$
- Obtuse angle  $90^0 \angle B \angle 180^0$
- Reflex angle  $180^0 \angle F \angle 360^0$
- Straight (flat) angle  $D = 180^0$
- Right angle  $L = 90^0$
- Angle of rotation  $S = 360^0$

**1.7.3.6.1 HOMEWORK ASSIGNMENT 1 AND 2**

- Acute  $\angle$
- Obtuse  $\angle$
- Obtuse  $\angle$

1.4 Reflex  $\angle$ 

- Obtuse  $\angle$
- Acute  $\angle$
- Acute  $\angle$
- Acute  $\angle$
- Acute  $\angle$
- Acute  $\angle$
- Acute  $\angle$
- Reflex  $\angle$
- Acute  $\angle$
- Obtuse  $\angle$
- Obtuse  $\angle$  and Acute  $\angle$
- Obtuse  $\angle$  and Acute  $\angle$

**CLASSWORK ASSIGNMENT 2**

- Acute angle
- one right angle
- one obtuse angle

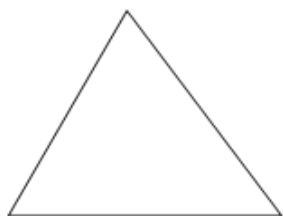
- acute-angled
- right-angled / acute-angled
- obtuse-angled
- right-angled

**1.7.4 Classification of triangles<sup>10</sup>****1.7.4.1 MATHEMATICS****1.7.4.2 Grade 8****1.7.4.3 INTEGERS, EQUATIONS AND GEOMETRY****1.7.4.4 Module 10****1.7.4.5 CLASSIFICATION OF TRIANGLES****CLASS ASSIGNMENT 1**

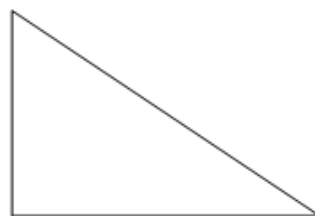
2. Classify the following triangles according to their angles (without the use of a protractor)

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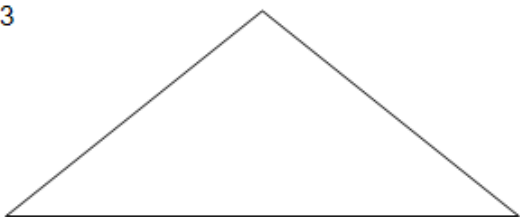
2.1



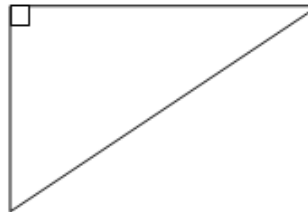
2.2



2.3



2.4



**Figure 1.30**

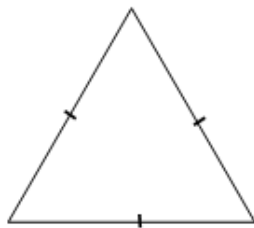
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4. Classify the following triangles according to their sides.

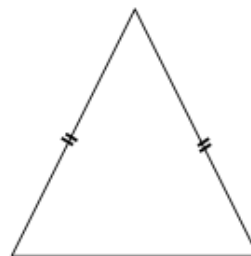
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<sup>10</sup>This content is available online at <http://cnx.org/content/m31542/1.1/>.

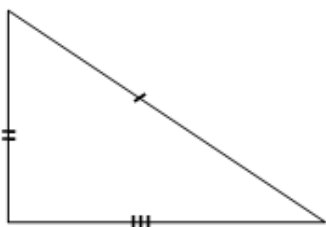
4.1



4.2



4.3



4.4

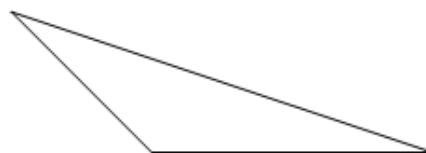


Figure 1.31

## CLASS ASSIGNMENT 3

Try and complete the theorems and explain the theorem on the basis of your own example (with the help of a sketch)

1.1 Theorem 1:

The sum of the angles on a straight line

Example:

1.2 Theorem 2:

Example:

1.3 Theorem 3:

The sum of the interior angles of any triangle is

Example: to prove the theorem, carry out the following instructions:

b) Mark the angles of the triangle with the letters A, B and C.

c) Tear off the angles of the triangle.

d) Paste the angles of the triangle next to one another on the line below so that the vertices face the point on the line.

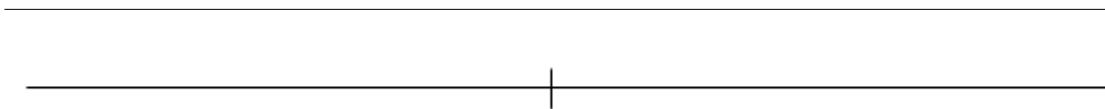


Figure 1.32

Complete the following equation:  $\overset{\ominus}{A} + \overset{\ominus}{B} + \overset{\ominus}{C} = \dots\dots\dots^\circ$   
 (Note how each angle is written.)

1.4 Theorem 4:

1.4.1 Before we look at theorem 4, it is important for you to understand the following terms. Explain the following terms with the aid of sketches:

- exterior angle of a triangle
- interior angle of a triangle

1.4.2 Complete:

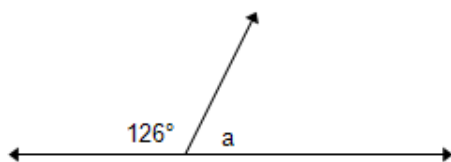
The exterior angle of a triangle is

Example: (Use degrees in your sketch)

- The above four theorems will serve as reasons when you calculate the sizes of unknown angles.
- When calculating the size of any angle, you must always give a reason for your explanation.

2. Calculate the sizes of the unknown angles and provide reasons. (Your teacher will help you with the more difficult examples.)

2.1




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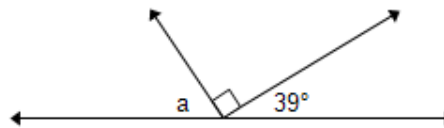


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2.2




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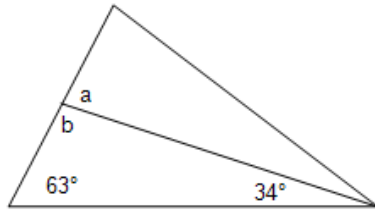
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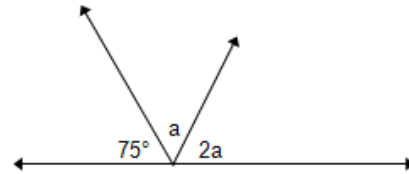
Figure 1.33

2.3



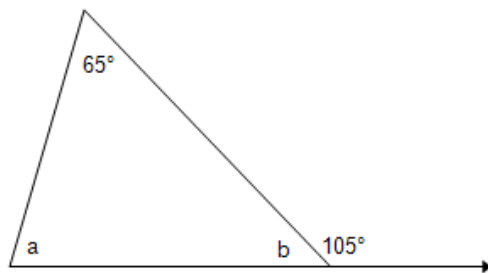
.....  
 .....  
 .....

2.4



.....  
 .....  
 .....

2.5



2.6

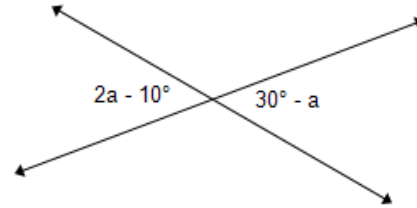
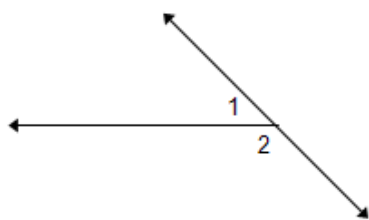


Figure 1.34

## HOMEWORK ASSIGNMENTS 2 AND 3

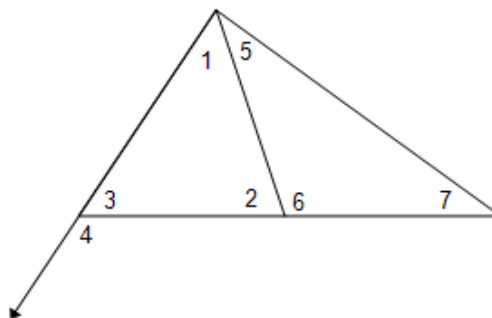
1. Complete each of the following and give reasons for the following theorems:

1.1



$$\hat{1} + \hat{2} = \dots\dots\dots^\circ ( \dots\dots\dots )$$

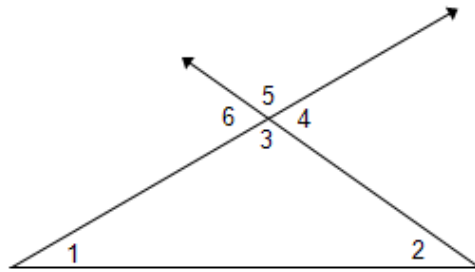
1.2



$$\hat{1} + \hat{2} + \hat{3} = \dots\dots\dots^\circ ( \dots\dots\dots )$$

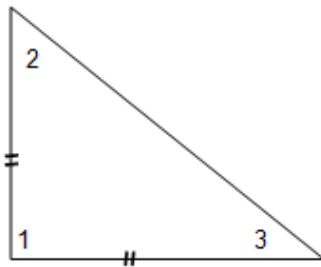
Figure 1.35

1.3



$$\hat{4} = \dots + \dots \text{ ( } \dots \text{ )}$$

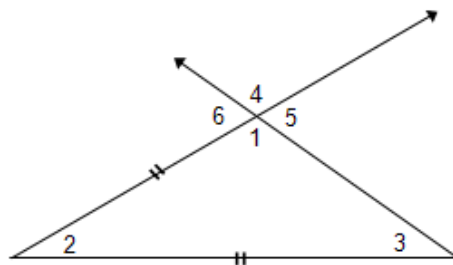
1.4



$$\hat{3} = \dots \text{ ( } \dots \text{ )}$$

Figure 1.36

1.5



$$\hat{1} = \dots = \dots = \dots \text{ ( } \dots \text{ )}$$

Figure 1.37



1. Calculate the sizes of each of the unknown angles and provide reasons for each.

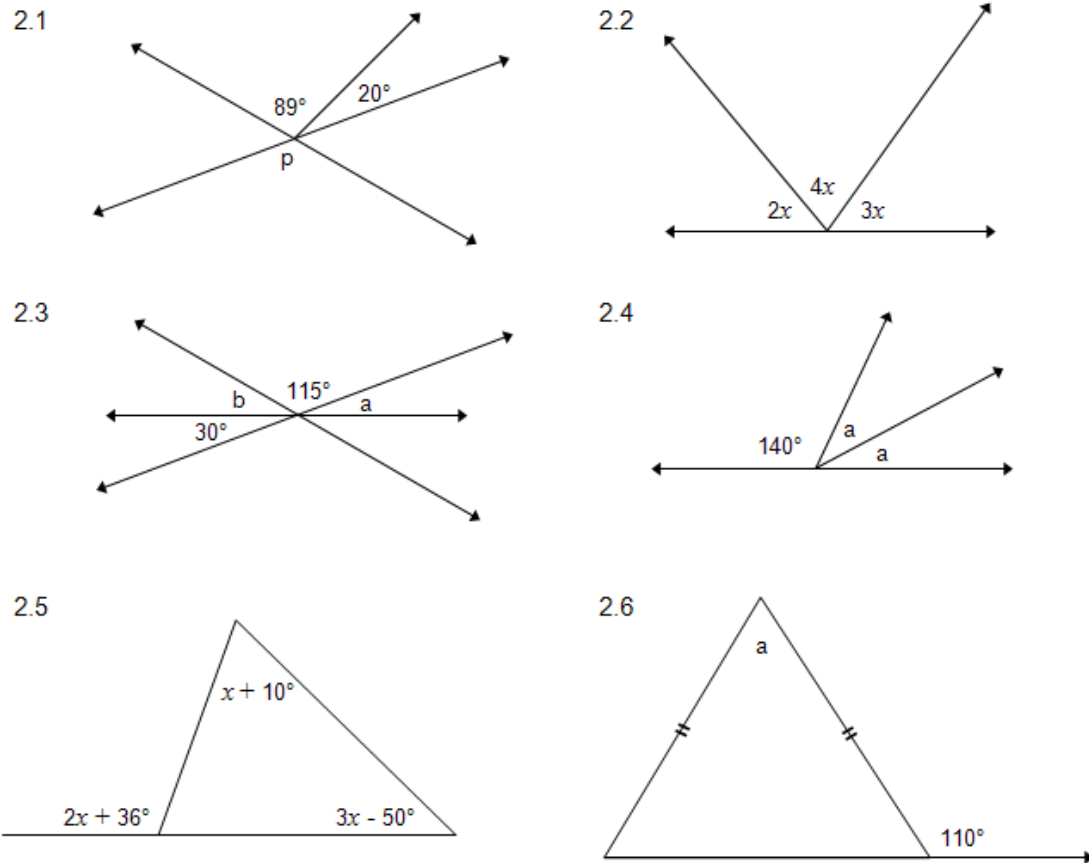


Figure 1.38

#### 1.7.4.6 Memorandum

##### CLASSWORK ASSIGNMENT 1

- acute-angled
- right-angled / acute-angled
- obtuse-angled
- right-angled
  
- equilateral
- isosceles
- scalene
- scalene

## CLASSWORK ASSIGNMENT 1

- $= 180^0$
- same size
- $180^0$

- Exterior  $\angle$

Interior

- Equal to the sum of the 2 subtended interior angles

$$x = 130^0 - 50^0 \\ = 80^0$$

- $a = 180^0 - 126^0$  (straight line)

$$= 54^0$$

$$2.2 \ 180^0 - (90^0 + 39^0) \text{ (straight line)} \\ = 51^0$$

$$2.3 \ b = 180^0 - (63^0 + 34^0) \ (3^{\angle s} = 180^0) \\ = 83^0$$

$$a = 180^0 - 83 \text{ (straight line)}$$

$$= 97^0 \ / \ \text{ext } \angle = \text{sum of opp}$$

$$2 \text{ int. } \angle s$$

$$2.4 \ 3a + 75 = 180^0 \text{ (straight line)}$$

$$3a = 105^0$$

$$a = 35^0$$

- $b = 180^0 - 105^0$  (straight line)

$$= 75^0$$

$$a = 180^0 - (65^0 + 75^0) \ (3^{\angle s} = 180^0) \\ = 40^0$$

- $2a - 10^0 = 30^0 - a$  (vert. opp  $\angle s$ )

$$3a = 40$$

$$a = \frac{40}{3}$$

$$a = 13,3^0$$

## HOMEWORK ASSIGNMENT 1 AND 2

$$\bullet \ \overset{\ominus}{1} + \overset{\ominus}{2} = 180^0 \text{ (str. line)}$$

$$\bullet \ \overset{\ominus}{1} + \overset{\ominus}{2} + \overset{\ominus}{3} = 180^0 \ (3^{\angle s} = 180^0)$$

$$\bullet \ \overset{\ominus}{4} = \overset{\ominus}{1} + \overset{\ominus}{2} \text{ (ext } \angle \text{ of } = \text{sum of 2 opp int. } \angle s)$$

$$\bullet \ \overset{\ominus}{3} = \overset{\ominus}{2} \text{ (isc)}$$

$$\bullet \ \overset{\ominus}{1} = \overset{\ominus}{3} = \overset{\ominus}{1} = \overset{\ominus}{4} \ ( \overset{\ominus}{1} = \overset{\ominus}{3} \text{ (isc)}; \overset{\ominus}{1} = \overset{\ominus}{4} \text{ (vert opp } \angle s))$$

$$2.1 \ p = 89^0 + 20^0 \text{ (vert opp } \angle s) \\ = 109^0$$

- $2x + 4x + 3x = 180^0$  (straight line)

$$9x = 180^0$$

$$x = 20^0$$

- $b = 180^0 - (115^0 + 30^0)$  (straight line)

$$= 35^0$$

$$a = 180^0 - (115^0 + 35^0) \text{ (straight line)}$$

$$= 30^0$$

- $a + a + 140^0 = 180^0$  (straight line)

$$2a = 40^0$$

$$a = 20^0$$

$$2.5x + 10^0 + 3x - 50^0 = 2x + 36^0 \text{ (ext } \angle \text{ of )}$$

$$x + 3x - 2x = 36^0 + 50^0 - 10^0$$

$$2x = 76^0$$

$$x = 38^0$$

$$2.6 p = r = (180^0 - 110^0) \text{ (straight line)}$$

$$= 70^0 \text{ (} p = r, \text{ isc )}$$

$$a = 180^0 - 140^0 \text{ (} 3\angle s = 180^0 \text{)}$$

$$= 40^0$$

# Chapter 2

## Term 3

### 2.1 To differentiate between rational and irrational numbers<sup>1</sup>

#### 2.1.1 MATHEMATICS

#### 2.1.2 Grade 8

#### 2.1.3 RATIONAL NUMBERS, CIRCLES AND TRIANGLES

#### 2.1.4 Module 15

#### 2.1.5 DIFFERENTIATING BETWEEN RATIONAL AND IRRATIONAL NUMBERS

##### 2.1.5.1 ACTIVITY 1

##### 2.1.5.2 Differentiating between rational and irrational numbers

##### 2.1.5.3 [LO 1.2.7]

1. Can you remember what each of the following represents?

$N = \{ \dots \}$

$N0 = \{ \dots \}$

$Z = \{ \dots \}$

$R = \{ \dots \}$

2. Provide the definition for:

a rational number:

an irrational number:

3. How would you represent each of the following?

3.1 Rational number..... 3.2 Irrational number .....

4. Complete the following table by marking relevant numbers with an X:

---

<sup>1</sup>This content is available online at <<http://cnx.org/content/m31126/1.1/>>.

	$\frac{2}{7}$	0	$\sqrt{1}$	$\sqrt{3}$	$\sqrt[3]{9}$	$\sqrt[3]{8}$	2,47	$\sqrt{1.45}$	$\sqrt{\frac{4}{8}}$	$\frac{\sqrt{16}}{\sqrt{9}}$
Rational	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Irrational	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Figure 2.1

5. Select the required numbers from the list:

$$-\frac{2}{3}; 1 + \sqrt{4}; \sqrt{9+4}; -4; 12\frac{1}{5}; \frac{1+\sqrt{2}}{\sqrt{2}}$$

5.1 Integers:

5.2 Rational numbers:

5.3 Irrational numbers:

6. Explain what you know about an equivalent fraction.

7. Provide two equivalent fractions for the following:  $\frac{2}{7} = \dots = \dots$

8. Provide the terms used to identify each of the following (e.g. proper fraction):

8.1  $\frac{2}{7}$

8.2  $\frac{7}{2}$

8.3  $6\frac{2}{7}$

8.4 0,67

8.5 0,67

8.6 23 %

Any of the above can be reduced to any of the others.

#### 2.1.5.4 ACTIVITY 2:

#### 2.1.5.5 Reduction of fractions to decimal numbers / recurring decimal numbers and vice versa

#### 2.1.5.6 [LO 1.2.2, 1.2.6, 1.3, 1.6.1, 1.9.1]

1. Use your pocket calculator to reduce the following fraction to a decimal number:

$$\frac{43}{20}$$

Figure 2.2

2. Explain how you would reduce this to a decimal number without the use of your pocket calculator. There are two methods:

Method 1: ..... (reduce denominator to 10 / 100 / 1 000)

Method 2: ..... (do division)

(Let your educator assist you.)

- Do you see that the answer is the same – if the denominator cannot be reduced to multiples of 10 you have to apply the second method.

3. Now reduce each of the following to decimal numbers (round off, if necessary, to two digits):

3.1  $\frac{5}{8}$  .....

3.2  $\frac{13}{4}$  .....

3.3  $5\frac{3}{4}$  .....

3.4  $3\frac{7}{8}$  .....

3.5  $\frac{6}{7}$  .....

3.6  $\frac{7}{9}$  .....

4. Write the following decimal numbers as fractions or mixed numbers:(N.B.: All fractions have to be presented in their simplest form.)

4.1 6,008 .....

4.2 4,65 .....

4.3 0,375 .....

4.4 7,075 .....

4.5 13,65 .....

4.6 0,125 .....

5. How do we reduce fractions to recurring decimal numbers?

E.g.  $\frac{5}{11}$

Step 1: place a comma after the 5, i.e. 5, 0000

Step 2: carry on dividing until a pattern becomes visible - the pattern will be indicated by the recurring numbers.

---


$$\begin{array}{r} 5 \overline{) 50 \overset{60}{0} 50 \overset{60}{0}} \\ \underline{11} \end{array}$$

$$\begin{array}{l} = 0.4545 \dots \text{ (45 is repeated --- 4 and 5 therefore are recurring)} \\ = 0.\dot{4}\dot{5} \end{array}$$

**Figure 2.3**

---

Now try the following:

5.1  $\frac{7}{9}$

5.2  $-5\frac{5}{6}$

5.3  $3\frac{13}{99}$

6. What is noticeable about fractions that are recurring decimal numbers (with regard to the denominator)?

7. Now, before we provide the steps for reducing a recurring decimal number to a common fraction, see if you are able to write the following as fractions by making use of the information from no. 6.

$$\begin{array}{ll}
 7.1 & 0,\dot{3} \dots\dots\dots \\
 7.2 & 0,4\dot{5} \dots\dots\dots \\
 7.3 & 0,0\dot{2}\dot{3} \dots\dots\dots \\
 7.4 & 0,00\dot{3} \dots\dots\dots
 \end{array}$$

Figure 2.4

8. The following provides complete steps for reducing a recurring decimal number to a common fraction:

---


$$\begin{array}{rcl}
 \text{e.g. } 0,\dot{1} = \text{?????} & \text{Let } 0,\dot{1} = x & \\
 & & 10x = 1,1111\dots \\
 & & - 1x = 0,1111\dots \\
 & & \hline
 & & 9x = 1 \\
 & & x = \frac{1}{9}
 \end{array}$$

Figure 2.5

*Suggestion:* Multiply by 10 (if you have one recurring figure). Multiply by 100 (if there are 2 recurring figures), etc.

9. Now try to do no. 7.2 in the way that is discussed in no. 8.

### 2.1.5.7 ACTIVITY 3

#### 2.1.5.8 Reducing percentages to fractions and vice versa

#### 2.1.5.9 [LO 1.2.2, 1.2.6, 1.6.1, 1.9.1]

1. What is the meaning of % (percentage)? .....
  2. If you have to reduce any fraction to a percentage, you have to reduce the denominator to 100.
- If this is not possible, you have to x

$$\frac{100\%}{1}$$

Figure 2.6

(This principle can be applied in any situation, e.g. when you want to reduce a test that is marked out of 15 to a mark out of 50, you need to multiply by  $\frac{50}{15}$ )

Reduce the following mathematics test marks from a grade 8 class to percentages (to one decimal figure, where necessary):

2.1  $\frac{17}{20}$  .....

2.2  $\frac{19}{40}$  .....

2.3  $\frac{38}{50}$  .....

2.4  $\frac{45}{60}$  .....

3. Reduce each of the following percentages to a common fraction (or a mixed number):

3.1 55 % .....

3.2 15,5% .....

3.3  $16\frac{1}{2}\%$  .....

3.4  $6\frac{2}{3}\%$  .....

4. Each South African citizen should have access to some means of transport.

Bolokanang has a community of 25 500 people. Study the accompanying table indicating the number of people that use the given means of transport and answer the questions that follow.

Vehicle	Number of users
Bicycle	$4\frac{1}{8}\%$
Car	$\frac{3}{5}$
Motorbike	0,085

**Table 2.1**

4.1 Indicate how many inhabitants make use of:

a) a bicycle

b) a car

c) a motorbike

4.2 Express the number of inhabitants that use a car as a fraction of those who travel by bicycle.

4.3 Which percentage of the inhabitants has no vehicle?

4.4 Which other means of transport do farm labourers use to get to the nearest town?

4.5 If the number of job opportunities in rural areas should increase, the fraction of citizens who use cars for transport will double. What fraction of the community will be using cars for transport under such conditions?

#### **2.1.5.10 ACTIVITY 4**

#### **2.1.5.11 Adding and subtracting rational numbers (fractions)**

#### **2.1.5.12 [LO 1.2.2, 1.2.5, 1.2.6, 1.6.2, 1.7.1, 1.7.2, 1.9.1]**

1. Reduce each of the following compound numbers to improper fractions. This is very important in addition, subtraction, multiplication and division of fractions.

1.1  $5\frac{4}{7}$  ..... 1.2  $7\frac{7}{9}$  .....

2. What is of cardinal importance before attempting to add or subtract fractions?

3. Show whether you are able to do the following:

3.1  $8 - 4\frac{3}{7}$

3.2  $3\frac{1}{9} - 1\frac{1}{2}$

- **Note this:** The denominators must be similar when you add fractions together or subtract them from one another.



e.g.  $2\frac{4}{7} - 1\frac{6}{7}$   
 $2 - 1 = 1$  and  
 $\frac{4}{7} - \frac{6}{7}$   
 (  $4 - 6$  — this is not possible. Carry one whole:  $1 = \frac{7}{7}$  )  
 (  $4 + 7 = 11$  — yes,  $11 - 6 = 5$  )  
 Answer:  $\frac{5}{7}$

- You could also reduce compound numbers to improper fractions and make the denominators similar.
- e.g.  $\frac{18}{7} - \frac{13}{7} = \frac{5}{7}$  ( $18 - 13 = 5$ : The denominators are the same. Subtract one numerator from the other.)

4. Do the following:

- 4.1  $4\frac{1}{7} + 4\frac{16}{42}$   
 4.2  $36 - 15\frac{6}{11}$   
 4.3  $\frac{1}{8} + 0,625 - \frac{3}{8}$   
 4.4  $4\frac{5}{10} + 7\frac{1}{2} + 6\frac{3}{4}$   
 4.5  $7\frac{1}{3} - 4\frac{7}{8}$   
 4.6  $7a - \frac{a}{4}$   
 4.7  $\frac{9}{a} + (\frac{6}{ab} - \frac{3}{b})$   
 4.8  $-6 + 2\frac{6}{7}$   
 4.9  $5 - (4\frac{4}{9} + 2\frac{2}{3})$   
 4.10  $3\frac{1}{3}a - 2\frac{1}{2}a$

### 2.1.5.13 ACTIVITY 1.5

### 2.1.5.14 Multiplication and division of rational numbers (fractions)

### 2.1.5.15 [LO 1.2.6, 1.6.2]

- You did this in grade 7 – let's refresh the memory.

1. Multiplication:

- **Important:** Write all compound numbers as fractions. Then do crosswise cancellation.

Try the following:

- $1\frac{1}{4} \times 2\frac{1}{2} \times 4$

2. Division:

- The reciprocal plays an important role in the division of fractions.

Use an example to explain this term.

e.g.  $\frac{1}{3} \div \frac{2}{3}$

- Both numbers are fractions
- Change  $\div$  to the  $\times$  sign and obtain the reciprocal of the denominator (fraction following the  $\div$  sign).
- Do cancellation as with multiplication.

3. Do the following:

- 3.1  $8 \div \frac{8}{11}$   
 3.2  $18 \div \frac{7}{8}$   
 3.3  $\frac{5}{6} \div \frac{5}{2}$   
 3.4  $-2\frac{2}{3} \div -1\frac{7}{9}$   
 3.5  $6\frac{3}{4}mn \div -6m^3$   
 3.6  $\frac{-4xy}{3ab} \div \frac{-2x}{3a}$

### 2.1.6 Assessment

Learning outcomes(LOs)
LO 1
Numbers, Operations and RelationshipsThe learner will be able to recognise, describe and represent numbers and their relationships, and to count, estimate, calculate and check with competence and confidence in solving problems.
Assessment standards(ASs)
We know this when the learner:
1.2 recognises, classifies and represents the following numbers to describe and compare them:
1.2.2 decimals, fractions and percentages;
1.2.5 additive and multiplicative inverses;
1.2.6 multiples and factors;
1.2.7 irrational numbers in the context of measurement (e.g. $\pi$ and square and cube roots of non-perfect squares and cubes);
1.3 recognises and uses equivalent forms of the rational numbers listed above;
1.6 estimates and calculates by selecting and using operations appropriate to solving problems that involve:
1.6.1 rounding off;
1.6.2 multiple operations with rational numbers (including division with fractions and decimals);
1.7 uses a range of techniques to perform calculations, including:
1.7.1 using the commutative, associative and distributive properties with rational numbers;
1.7.2 using a calculator;
1.9 recognises, describes and uses:
1.9.1 algorithms for finding equivalent fractions;
1.9.2 the commutative, associative and distributive properties with rational numbers (the expectation is that learners should be able to use these properties and not necessarily to know the names of the properties).

Table 2.2

### 2.1.7 Memorandum

#### ACTIVITY 1

1. Natural numbers  
Counting numbers  
Integers  
Real numbers
2.  $\frac{a}{b}$ ;  $b \neq 0$

$$\sqrt{2} \quad (2.1)$$

3.1 Q

- $Q^1$

4.

		0	$\sqrt{1}$	$\sqrt{3}$	$\sqrt[3]{9}$	$\sqrt[3]{8}$	2,47	$\sqrt{1,45}$	$\sqrt{\quad}$	$\sqrt{\quad}$
Rational	$\sqrt{\quad}$	$\sqrt{\quad}$	$\sqrt{\quad}$			$\sqrt{\quad}$	$\sqrt{\quad}$			$\sqrt{\quad}$
Irrational				$\sqrt{\quad}$	$\sqrt{\quad}$			$\sqrt{\quad}$	$\sqrt{\quad}$	

Table 2.3

- $1 + \sqrt{4}$ ; -4
- $\frac{-2}{3}$ ;  $12 \frac{1}{5}$
- $\sqrt{9+4}$ ;  $\frac{1+\sqrt{2}}{\sqrt{2}}$

6. Equal in value

7.  $\frac{4}{14} = \frac{6}{24}$  etc

- Proper fraction
- Improper fraction
- Mixed number
- Decimal number
- Recurring decimal number
- Percentage

## ACTIVITY 2

1. 2,15

- 0,625
- 3,25
- 5,75
- 2,875
- $\frac{6,000}{7} = 0,8571 \dots \approx 0,86$
- $\frac{7,000}{9} = 0,777 \dots = 0,7$  or 0,8
- $6 \frac{8}{1000} = 6 \frac{1}{125}$
- $4 \frac{65}{100} = 4 \frac{13}{20}$
- $\frac{375}{1000} = \frac{3}{8}$
- $7 \frac{75}{1000} = 7 \frac{3}{40}$
- $13 \frac{65}{100} = 13 \frac{13}{20}$
- $\frac{125}{1000} = \frac{1}{8}$

5.1  $\frac{7,000}{9} = 0,7$ 5.2  $-5,83 \frac{5,000}{6} = 0,8333 \dots$ 5.3  $3,13 \frac{13,0000}{99} = 0,1313 \dots$ 7.1  $\frac{3}{9} = \frac{1}{3}$ 7.2  $\frac{45}{99} = \frac{5}{11}$ 7.3  $\frac{23}{990}$ 7.4  $\frac{3}{900} = \frac{1}{300}$ 9.  $0,45 = x$  $x = 0,4545 \dots$  [U+F081] $100 x = 45,4545 \dots$  [U+F082]

- $- [\text{U+F081}] \ 99 \ x = 45$

$$x = \frac{45}{99} = \frac{5}{11}$$

## ACTIVITY 3

$$2.1 \ \frac{17 \times 5}{20 \times 5} = 85\%$$

$$2.2 \ \frac{19}{40} \times \frac{100}{1} = 47,5\%$$

$$2.3 \ \frac{38 \times 2}{50 \times 2} = 76\%$$

$$2.4 \ \frac{45}{60} \times \frac{100}{1} = 75\%$$

$$3.1 \ \frac{35}{100} = \frac{11}{20}$$

$$3.2 \ \frac{15,5}{100} = 0,155 = \frac{155}{1000} = \frac{31}{200}$$

$$3.3 \ \frac{33}{200}$$

$$3.4 \ \frac{20}{30} = \frac{2}{3}$$

$$4.a) \ \frac{33}{800} \times \frac{25500}{1} = 1 \ 052$$

$$b) \ \frac{3}{5} \times \frac{25500}{1} = 15 \ 300$$

$$c) \ \frac{85}{1000} \times \frac{25500}{1} = 2 \ 167,5 \ 2 \ 168$$

- $(14,5) \ \frac{15300}{1052} = \frac{7650}{526} = \frac{3825}{263}$

- $25 \ 500 - 18 \ 520 = 6 \ 980$

## 4.4

$$4.5 \ \frac{3}{5} \times \frac{2}{1} = \frac{6}{5} = 1 \frac{1}{5}$$

## ACTIVITY 4

$$1.1 \ \frac{39}{7}$$

$$1.2 \ \frac{70}{9}$$

2. Numbers must be the same

$$3.1 \ 3 \frac{4}{7}$$

$$3.2 \ 2 \frac{2-9}{18} = 1 \frac{20-9}{18} = 1 \frac{11}{18}$$

$$4.1 \ \frac{29}{7} + \frac{184}{42} = \frac{174+184}{42} = \frac{358}{42} = 8 \frac{22}{42} = 8 \frac{11}{21}$$

$$4.2 \ 21 - \frac{6}{11} = 20 \frac{5}{11}$$

- $0,125 + 0,625 - 0,375 = 0,375$

- $17 \frac{10+10+15}{20} = 17 \frac{35}{20} = 18 \frac{15}{20} = 18 \frac{3}{4}$

- $3 \frac{3-21}{24} = 2 \frac{11}{24}$

- $\frac{28a^2-a}{4}$

$$4.7 + \left( \frac{6-3a}{ab} \right) = \frac{9b+6-3a}{ab}$$

$$4.8 \ \frac{-6}{1} + \frac{20}{7} = \frac{-42+20}{7} = \frac{-22}{7} = -3 \frac{1}{7}$$

- $5 - (6 \frac{4+6}{9}) = 5 - 6 \frac{10}{9} = 5 - 7 \frac{1}{9}$

$$= - \frac{64}{9}$$

$$= \frac{45-64}{9}$$

$$= \frac{-19}{9} = -2 \frac{1}{9}$$

- $\frac{10a}{3} - \frac{5a}{2} = \frac{20a-15a}{6}$

$$= \frac{5a}{6}$$

## ACTIVITY 5

$$1. \ \frac{5}{14} \times \frac{5}{2} \times \frac{4^1}{1} = \frac{25}{2} = 12 \frac{1}{2}$$

$$3.1 \ \frac{8}{1} \div \frac{8}{11} = \frac{8^1}{1} \times \frac{11}{8_1} = 11$$

$$3.2 \ \frac{18}{1} \times \frac{8}{7} = \frac{144}{7} = 20 \frac{4}{7}$$

$$3.3 \quad \frac{5^1}{6_3} \times \frac{2^1}{5_1} = \frac{1}{3}$$

$$3.4 \quad \frac{-8^1}{3_1} \times \frac{-9^3}{16_2} = \frac{3}{2} = 1\frac{1}{2}$$

$$3.5 \quad \frac{27^9 mn}{4} \times \frac{1}{-6_2 m^3} = \frac{-9n}{8m^2}$$

$$3.6 \quad \frac{-4^2 xy}{3_1 ab} \times \frac{3a}{-2x} = \frac{2y}{b}$$

## 2.2 The characteristics of a circle<sup>2</sup>

### 2.2.1 MATHEMATICS

#### 2.2.2 Grade 8

### 2.2.3 RATIONAL NUMBERS, CIRCLES AND TRIANGLES

#### 2.2.4 Module 13

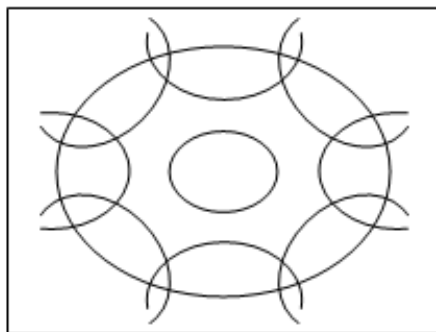
### 2.2.5 THE CHARACTERISTICS OF A CIRCLE

#### 2.2.5.1 ACTIVITY 1

##### 2.2.5.2 Discovering the characteristics of a circle

##### 2.2.5.3 [LO 3.1, 4.2.1, 3.4]

1. Try to copy the following design, using a pair of compasses only:



**Figure 2.7**

2. Draw a circle of any size. Refer to a textbook or any other source of information to help you indicate the following on the circle:

2.1 Centre: *T*

2.2 Diameter (Name it *PQ*.)

2.3 Radius: *TS*

<sup>2</sup>This content is available online at <<http://cnx.org/content/m31140/1.1/>>.

- 2.4 Any arc:  $FG$
- 2.5 Sector:  $PTW$  (shade this portion.)
- 2.6 Chord:  $KL$
- 2.7 Use a coloured pencil to indicate where you would determine the circumference of the circle.
- 3. Refer to your sketch to answer the following questions:
- 3.1 What is characteristic of  $TW$ ,  $PT$ ,  $TS$  and  $TQ$ ?
- 3.2 Measure  $P\overset{\ominus}{T}W$ .
- 3.3 What is the size of  $P\overset{\ominus}{T}Q$ ?
- 3.4 What do we call this type of angle?
- 4. Construct the following with the help of a pair of compasses:
- 4.1 a circle with a diameter measuring 4 cm
- 4.2 a circle with a radius of 1,5 cm
- 5. How would you go about constructing a circle of 4 m?

- Plan:

#### 2.2.5.4 ACTIVITY 2

#### 2.2.5.5 Discovering the circumference of a circle and dealing with related problems

#### 2.2.5.6 [LO 4.2.2, 4.3.1, 4.3.2, 4.3.3, 4.4, 4.5.1]

1. Make use of about four bottles / cups of different sizes. Use a length of string and measure the diameter of each of the bottles to complete the following table:

	circumference (O)	diameter (m/d)	$O \div m/d$
Bottle 1			
Bottle 2			
Bottle 3			
Bottle 4			

**Table 2.4**

- What is noticeable in the last column?

circumference  $\div$  diameter

- 1.2 What is the term used for the answer in the last column?
- 1.3 Name two values that can be used for  $\pi$ : ..... or .....
- 1.4 Which formula can therefore be used to calculate the circumference of any circle?
2. We could also deduce this formula from a circle by proceeding as follows:
- 2.1 Draw a circle with centre  $P$  and radius 25 mm on a sheet of paper.
- 2.2 Cut out the circle and place a mark anywhere on the edge of the cut circle.
- 2.3 Draw a line (use a ruler) across the remaining area of the sheet of paper. Roll the circle (cut out disk) on its edge along this line (place the mark on the edge of the circle at the beginning of the ruled line. Mark the spot where the rotation is completed on the line when the rolled circle has completed a full rotation.
- 2.4 Use your ruler to measure the marked distance.

- Distance: ..... mm

2.5 What term would we use to describe the distance that was measured in 2.4?

2.6 Use your calculator to calculate the following:

- circumference  $\div$  diameter = .....  $\div$  ..... = .....

2.7 What term do we use to describe the answer that you have obtained?

3. What do we actually mean when we say that the wheel of a bicycle has completed a full rotation?

4. Write the formula for calculating the circumference of a circle on the following line and answer the questions that follow:

- Circumference = .....

4.1 How would you calculate the radius of a circle when the circumference is provided?

- Radius ( $R$ ) = .....

4.2 How would you calculate the diameter of a circle when the circumference is provided?

- Diameter ( $d$ ) = .....

Now you should be able to answer any question dealing with the diameter, radius or circumference of a circle or wheel or any circular object.

5. Use your pocket calculator to calculate the circumference of each of the following circles:

**Note this:** Always write out the formula before you start. ( $\pi = 3,14$ ).

5.1  $r = 230$  mm

5.2  $r = 1,45$  cm (answer to 2 decimal figures)

6. Determine the circumference of each of the following without the use of a pocket calculator.

**Note this:** Always write out the formula before you start. ( $\pi = \frac{22}{7}$ )

6.1  $r = 14$  cm

6.2  $d = 35$  cm

1. Calculate the radius of the following circle:

You may use your pocket calculator, but you have to show all the steps of the calculation. ( $\pi = \frac{22}{7}$ )

7.1 circumference 242 mm

8. How many rotations will the wheel of a mountain bike complete over a distance of 7,5 m if the diameter of the wheel is 67 cm?

### 2.2.5.7 ACTIVITY 3

#### 2.2.5.8 Discovering the area of a circle and solving related problems

#### 2.2.5.9 [LO 4.2.1, 4.5.1, 4.3]

1. Can you remember the formula for calculating the area of a rectangle?

2. Draw a circle with centre  $O$  and a radius of 60 mm on a sheet of paper. Divide the circle into 32 equal sectors. Use red for colouring 16 sectors and blue for the remaining 16 sectors.

3. Cut out all 32 sectors and arrange them in line in such a way that the segments eventually form a rectangular paving design.

Paste your triangles in the following space

4. Measure both the length and breadth of the rectangle. Use the formula from no. 1 to calculate the area of the rectangle.

5. What do you deduce with regard to the rectangle and the circle that you have drawn in no. 2?

6. Which unit of measurement is used for calculating area?

7. Provide the formula for calculating the area of any circle.

8. Calculate the area of the circle you have drawn in no. 2 with the help of the formula from no. 7.

What do you notice?

9. Calculate the area of each of the following circles without making use of a pocket calculator.



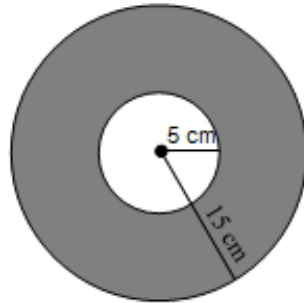
- ( $\pi = \frac{22}{7}$ )

9.1  $r = 14,7$  cm 9.2  $d = 56,49$  cm

10. Calculate the area of the shaded parts.

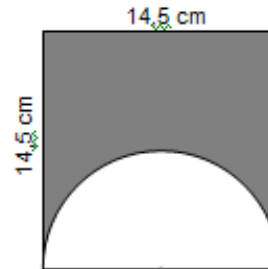
- You may use your pocket calculator for this. ( $\pi = 3,14$ )

A:



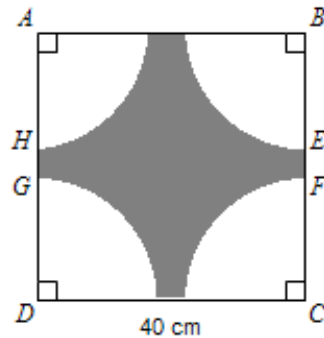
.....  
 .....  
 .....  
 .....

B:



.....  
 .....  
 .....  
 .....

11. Calculate the area of the shaded parts.



$BE = FC = 15$  cm  
 $EF = 10$  cm

Figure 2.8

## 2.2.6 Assessment

LO4
MeasurementThe learner will be able to use appropriate measuring units, instruments and formulae in a variety of contexts.
We know this when the learner:
4.2 solves problems involving:
4.2.1 length;
4.2.2 perimeter and area of polygonals and circles;
4.3 solves problems using a range of strategies including:
4.3.1 estimating;
4.3.2 calculating to at least two decimal positions;
4.3.3 using and converting between appropriate SI units;
4.4 describes the meaning of and uses $\pi$ in calculations involving circles and discusses its historical development in measurement;
4.5 calculates, by selecting and using appropriate formulae:
4.5.1 perimeter of polygons and circles;
4.5.2 area of triangles, rectangles circles and polygons by decomposition into triangles and rectangles;
<ul style="list-style-type: none"> <li>investigates (alone and / or as a member of a group or team) the relationship between the sides of a right-angled triangle to develop the Theorem of Pythagoras;</li> </ul>
4.9 uses the Theorem of Pythagoras to calculate a missing length in a right-angled triangle leaving irrational answers in surd form ( $\sqrt{\phantom{x}}$ );
4.10 describes and illustrates ways of measuring in different cultures throughout history (e.g. determining right angles using knotted string leading to the Theorem of Pythagoras).

Table 2.5

## 2.2.7 Memorandum

### ACTIVITY 2

$$5.1 \ O = \pi \times d$$

$$O = \pi \times 460$$

$$O = 1\,444,4 \text{ mm}$$

$$5.2 \ C = \pi \times d$$

$$C = \pi \times 2,9$$

$$C \ 9,11 \text{ cm}$$

$$6.1 \ C = \pi \times d$$

$$C = \frac{22}{7} \times \frac{28^4}{1}$$

$$C = 88 \text{ cm}$$

$$6.2 \ C = \pi \times d$$

$$C = \frac{22}{7} \times \frac{35^5}{1}$$

$$C = 110 \text{ cm}$$

$$7.1 \ C = \pi \times d$$

$$242 = \frac{22}{7} \times d$$

$$\frac{242}{1} \times \frac{22}{7} = d$$

$$\therefore d = 77 \text{ mm}$$

$$8. C = \pi \times d \ 750 \div 210,38 \text{ cm}$$

$$= 3,14 \times 67 \text{ cm} = 3,6 \text{ revolutions}$$

$$= 210,38 \text{ cm}$$

ACTIVITY 3

$$9. A = \pi \times r^2$$

$$= \frac{22}{7} \times \frac{14,7}{1} \times \frac{14,7}{1}$$

$$= 679,14 \text{ cm}^2$$

$$\bullet \ r = 28,25$$

$$A = 2 \ 505,92 \text{ cm}^2$$

10. **A B**

$$(3,14 \times 15^2) - (3,14 \times 15^2) \ (14,5)^2 - (3,14 \times 7,25^2 \times \frac{1}{2})$$

$$= 706,5 - 78,5 = 210,25 - 82,52$$

$$= 628 \text{ cm}^2 = 127,73 \text{ cm}^2$$

$$11. (40 \times 40) - (3,14 \times 15^2)$$

$$= 1 \ 600 - 706,5$$

$$= 893,5 \text{ cm}^2$$

## 2.3 Classifying and constructing triangles<sup>3</sup>

### 2.3.1 MATHEMATICS

#### 2.3.2 Grade 8

#### 2.3.3 RATIONAL NUMBERS, CIRCLES AND TRIANGLES

#### 2.3.4 Module 14

#### 2.3.5 CLASSIFYING AND CONSTRUCTING TRIANGLES

##### 2.3.5.1 ACTIVITY 1

##### 2.3.5.2 Classifying triangles, discovering important theorems about triangles and constructing triangles

##### 2.3.5.3 [LO 3.1, 3.3, 3.4, 4.2.1]

- By the end of this learning unit, you will be able to do the following:
  - understand how important the use of triangles is in everyday situations;
  - explain how to find the unknown sides of a right-angled triangle (Pythagoras);
  - calculate the area of a triangle;
  - enjoy the action in geometry;
  - use mathematical language to convey mathematical ideas, concepts, generalisations and mental processes.

1. When you classify triangles you can do it according to the angles or according to the sides.

1.1 Classification on the basis of the angles of a triangle: Are you able to complete the following?

a) Acute-angled triangles are triangles with

---

<sup>3</sup>This content is available online at <<http://cnx.org/content/m31148/1.1/>>.

- b) Right-angled triangles have
- c) Obtuse-angled triangles have

1.2 Classification on the basis of the sides of the triangle: Are you able to complete the following?

- a) An isosceles triangle has
- b) An equilateral triangle has
- c) A scalene triangle's

2. Are you able to complete the following theorems about triangles? Use a sketch to illustrate each of the theorems graphically.

**THEOREM 1:**

- The sum of the interior angles of any triangle is.....

Sketch:

**THEOREM 2:**

- The exterior angle of a triangle is

Sketch:

3. Constructing triangles:

- Equipment: compasses, protractor, pencil and ruler

Remember this:

- Begin by drawing a rough sketch of the possible appearance.
- Begin by drawing the base line.

3.1 Construct  $\triangle PQR$  with  $PQ = 7$  cm,  $PR = 5$  cm and  $\angle P = 70^\circ$ .

a) *Sketch:*

b) Measure the following:

1.  $QR = \dots\dots\dots$
2.  $\angle R = \dots\dots\dots$
3.  $\angle Q = \dots\dots\dots$
4.  $\angle P + \angle Q + \angle R = \dots\dots\dots$

3.2 Construct  $\triangle KLM$ , an equilateral triangle.  $KM = 40$  mm,  $KL = LM$  and  $\angle K = 75^\circ$ . Indicate the sizes of all the angles in your sketch.

Sketch:

## 2.3.6 ACTIVITY 2

### 2.3.7 Discovering the Pythagorean theorem of Pythagoras and calculating unknown sides with the help of this theorem

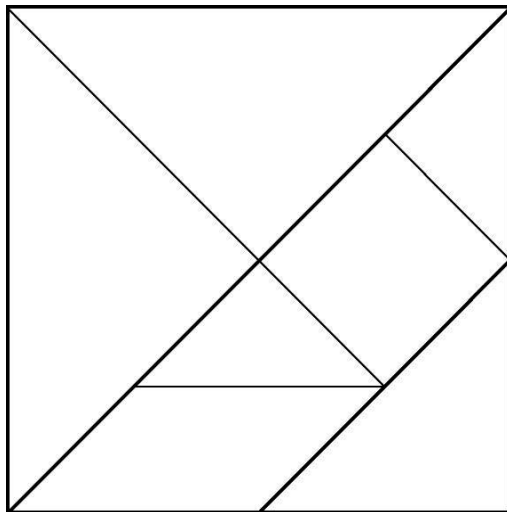
### 2.3.8 [LO 4.2.1, 4.8, 4.9, 4.10]

- The following could be done in groups.

Practical exercise: Making your own tangram.

1. Cut out a cardboard square (10 cm x 10 cm).
2. Draw both diagonals, because they form part of the bases of some figures.
3. Divide the square in such a way that the complete figure consists of the following:
  - 3.1 two large equilateral triangles with bases of 10 cm in length;
  - 3.2 two smaller equilateral triangles, each with base 5 cm in length;
  - 3.3 one medium equilateral triangle with adjacent sides 5 cm in length;
  - 3.4 one square with diagonals of 5 cm;
  - 3.5 one parallelogram with opposite sides of 5 cm.

- Make two of these. Cut along all the lines so that you will have two sets of the above shapes.



**Figure 2.9**

---

4. Now trace the largest triangle of your tangram in your workbook as a right-angled triangle.
5. Arrange the seven pieces to form a square and place this on the hypotenuse of the traced triangle.
6. Now arrange the two largest triangles to form a square and place this on one of the sides adjacent to the right angle of the traced triangle.
7. Arrange the remaining pieces to form a square and place this on the other adjacent side.
8. Calculate the area of each square.
9. What can you deduce from this exercise?
10. Deduction: Write out Pythagoras' theorem in the space below by making use of the triangle that is provided.
11. Solve  $x$  in each of the following triangles: (You may make use of your calculator.)

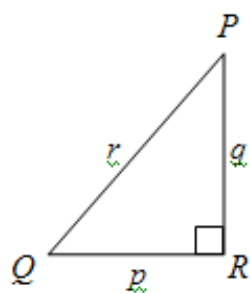
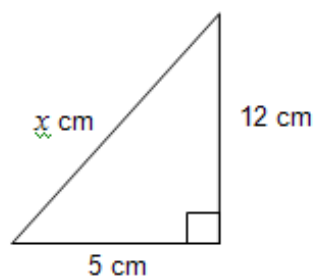


Figure 2.10

11.1



11.2

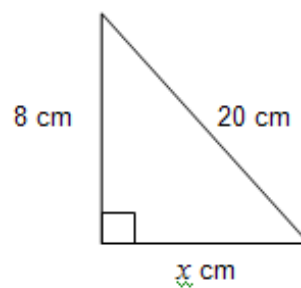


Figure 2.11

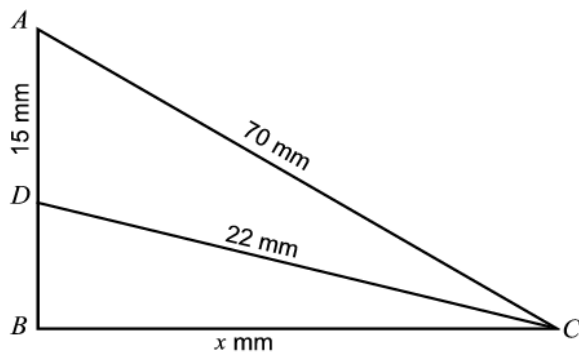


Figure 2.12

11.3

1.4

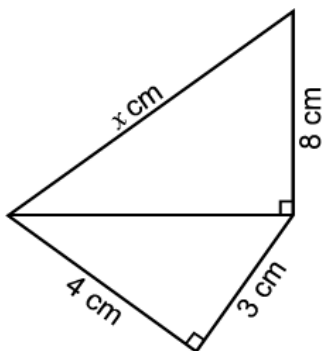


Figure 2.13

12. Do the calculations to determine whether the following is a right-angled triangle or not:

12.1  $\triangle DEF$  with  $DE = 8$  cm,  $EF = 10$  cm,  $DF = 6$  cm

13. AREA OF TRIANGLES

13.1 Construct rectangle  $ABCD$  with  $AB = 45$  mm and  $AD = 25$  mm on a sheet of paper and cut it out. Draw diagonal  $AC$ .

13.2 Calculate the area of rectangle  $ABCD$ .

13.3 Cut out  $\triangle ABC$ . What is the area of  $\triangle ABC$ ? Paste it here.

- Area of  $\triangle ABC = \dots\dots\dots \text{mm}^2$

13.4 Are you able to develop a formula for determining the area any triangle?

Write it here:

13.5 Calculate the area of  $\triangle ABC$ .

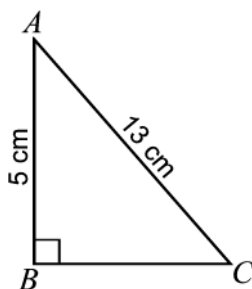


Figure 2.14

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13.6 In the figure  $SQ = 15\text{ cm}$ ,  $QR = 7\text{ cm}$  and  $PR = 9\text{ cm}$ .

**Important:** Provide all necessary information on your sketch. Check to see what you may need to complete the instructions fully.

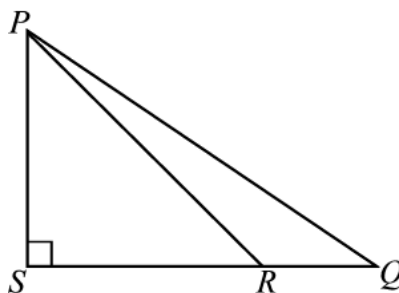


Figure 2.15

- 
- (a) Calculate the area of  $\triangle PSQ$  (accurate to 2 decimals).  
(b) Now calculate the area of  $\triangle PSR$ . **Suggestion:** You will first have to calculate the area of another triangle.

13.7 Calculate the area of  $ABCD$ .



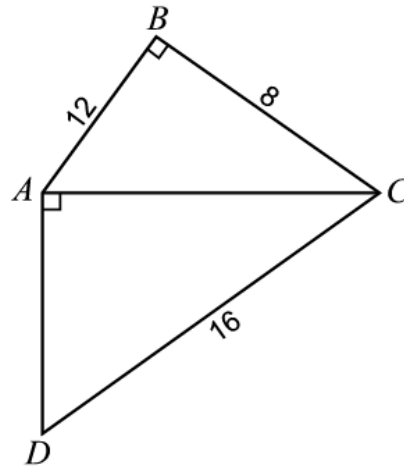


Figure 2.16

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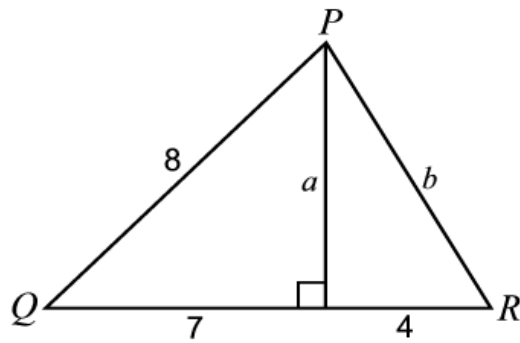


Figure 2.17

14. Calculate the length of the unknown sides of each of the following:  
14.1

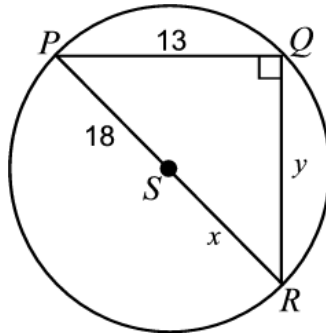


Figure 2.18

14.2

14.3

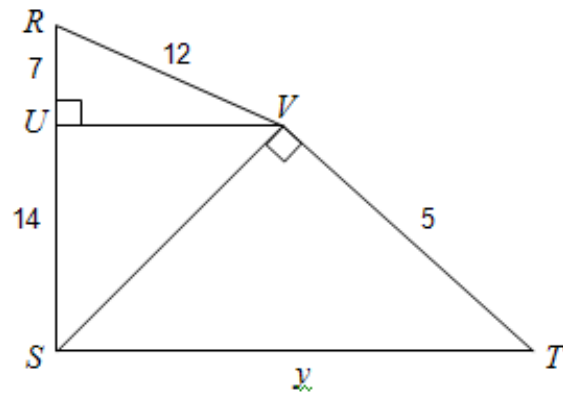


Figure 2.19

15. Playing in a park is a necessary aspect of the development of a child.

- You have been asked to supply slides. The problem that is involved requires calculating the length of the poles that are needed. Make use of the knowledge that you have accumulated to supply a plan to erect the slides.

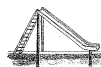


Figure 2.20

The following is required:

- 15.1 a sketch
- 15.2 a scale, e.g. 1 cm = 1 m
- 15.3 Calculations must be completed fully.

### 2.3.9 Assessment

LO 3
Space and Shape (Geometry)The learner will be able to describe and represent characteristics and relationships between two-dimensional shapes and three-dimensional objects in a variety of orientations and positions.
We know this when the learner:
3.2 in context that include those that may be used to build awareness of social, cultural and environmental issues, describes and classifies geometric figures and solids in terms of properties, including:
3.2.1 sides, angles and diagonals and their interrelationships, with focus on triangles and quadrilaterals (e.g. types of triangles and quadrilaterals).
LO4
MeasurementThe learner will be able to use appropriate measuring units, instruments and formulae in a variety of contexts.
We know this when the learner:
4.2 solves problems involving:
4.2.1 length;
4.2.2 perimeter and area of polygonals and circles;
4.3 solves problems using a range of strategies including:
4.3.1 estimating;
4.3.2 calculating to at least two decimal positions;
<i>continued on next page</i>

4.3.3 using and converting between appropriate SI units;
4.4 describes the meaning of and uses $\pi$ in calculations involving circles and discusses its historical development in measurement;
4.5 calculates, by selecting and using appropriate formulae:
4.5.1 perimeter of polygons and circles;
4.5.2 area of triangles, rectangles circles and polygons by decomposition into triangles and rectangles;
<ul style="list-style-type: none"> <li>investigates (alone and / or as a member of a group or team) the relationship between the sides of a right-angled triangle to develop the Theorem of Pythagoras;</li> </ul>
4.9 uses the Theorem of Pythagoras to calculate a missing length in a right-angled triangle leaving irrational answers in surd form ( $\sqrt{\quad}$ );
4.10 describes and illustrates ways of measuring in different cultures throughout history (e.g. determining right angles using knotted string leading to the Theorem of Pythagoras).

Table 2.6

### 2.3.10 Memorandum

#### ACTIVITY 1

1.1 a) all 3 Acute-angled

b) one  $90^\circ$  angled

c) one obtuse-angled

1.2 a) 2 even sides

b) 3 even sides

c) sides differ in length

2. The sum of the interior angles of any triangle is  $180^\circ$

#### ACTIVITY 2

10.  $r^2 = p^2 + q^2$

- $x^2 = 12^2 + 5^2$

$$= 144 + 25$$

$$= 169$$

$$\therefore x = 13$$

- $20^2 = 8^2 + x^2$

$$x^2 = 400 - 64$$

$$= 336$$

$$\therefore x = 18,3 \text{ cm}$$

11.3  $\nabla ABC$ :  $x^2 = 70^2 - 29^2$

$$= 4\,900 - 841$$

$$= 4\,059$$

$$\therefore x = 63,7 \text{ mm}$$

11.4  $y^2 = 4^2 + 3^2$

$$= 16 + 9$$

$$= 25$$

$$\therefore x = 5 \text{ cm}$$

$$12. DE^2 + DF^2 = 100 = EF^2$$

$\therefore DEF$  right angled

(Pythagoras)

- $\frac{1}{2} \times b \times h$
- $BC^2 = 13^2 - 5^2$

$$= 169 - 25$$

$$= 144$$

$$\therefore BC = 12 \text{ cm}$$

$$\text{Area } ABC = \frac{1}{2} \times b \times h$$

$$= \frac{1}{2} \times 12 \times 5$$

$$= 30 \text{ cm}^2$$

$$13.6 \text{ (a) } PS^2 = 9^2 - 8^2$$

$$= 81 - 64$$

$$= 17$$

$$\therefore PS = 4,12 \text{ cm}$$

$$\text{Area } PSQ = \frac{1}{2} \times b \times h$$

$$= \frac{1}{2} \times 15 \times 4,12$$

$$= 30,9 \text{ cm}^2$$

$$13.6 \text{ (b) Area } PSR = \frac{1}{2} \times 8 \times 4,12$$

$$= 16,4 \text{ cm}^2$$

$$\text{Area } PRQ = \text{area } PSQ - PSR$$

$$= 30,9 - 16,4$$

$$= 14,5 \text{ cm}^2$$

$$13.7 AC^2 = 12^2 + 8^2$$

$$= 208$$

$$\therefore AC = 14,4$$

$$AD^2 = 16^2 - 14,4^2$$

$$= 256 - 207,36$$

$$= 48,64$$

$$\therefore AD = 6,97$$

$$\text{Area } ABCD = \text{area } ABC + \text{area } ACD$$

$$= \left(\frac{1}{2} \times 12 \times 8\right) + \left(6,97 \times 14,4 \times \frac{1}{2}\right)$$

$$= 48 + 50,18$$

$$= 98,18 \text{ square units}$$

- $a^2 = 8^2 - 7^2$

$$= 15$$

$$\therefore a = 3,9$$

$$b^2 = (3,9)^2 + 4^2$$

$$= 15,21 + 16$$

$$= 31,21$$

$$\therefore b = 5,6$$

- $x = 18$  (radius)

$$y^2 = 36^2 - 13^2$$

$$= 1296 - 169$$

$$= 1127$$

$$\therefore y = 33,6$$

- $UV^2 = 12^2 - 7^2$

$$= 95$$

$$\therefore UV = 9,8$$

$$VS^2 = 14^2 + (9,8)^2$$

$$= 196 + 95$$

$$= 291$$

$$\therefore VS = 17,1$$

$$y^2 = (17,1)^2 + 5^2$$

$$= 291 + 25$$

$$= 316$$

$$\therefore y = 17,8$$

# Chapter 3

## Term 4

### 3.1 The concept of ratio and ratios in their simplest form<sup>1</sup>

#### 3.1.1 MATHEMATICS

#### 3.1.2 Grade 8

#### 3.1.3 RATIO AND PROPORTION

#### 3.1.4 MEASUREMENT

#### 3.1.5 CONSTRUCTIONS

#### 3.1.6 Module 15

#### 3.1.7 THE CONCEPT RATIO AND RATIOS IN THEIR SIMPLEST FORM

##### 3.1.7.1 ACTIVITY 1

##### 3.1.7.2 Explaining the concept of ratio and expressing ratios in their simplest form

##### 3.1.7.3 [LO 1.4, 1.5]

1. The [ : ] sign means that you can express two or more quantities (of the same kind) as a ratio, e.g., if you receive R10 and I receive R15, we could express the two amounts as a ratio: 10 : 15.

Note: Units are not named when we deal with ratios.

2. Ratios can also be written as fractions and be simplified,

$\frac{2}{3} : \frac{10}{15}$  e.g.:

10 : 15 = = 2 : 3 (The ratio is now expressed in its simplest form.)

3. How are the following ratios expressed in its simplest form?  $1\frac{1}{4} : 1\frac{1}{8}$  ?

Suggestion: Write mixed numbers as fractions and treat the problem as division of fractions.

4. Now write each of the following ratios in its simplest form:

4.1: 18 : 24 : 30

4.2:  $3\frac{1}{2}$  :  $4\frac{1}{2}$

4.3: 70 min :  $1\frac{1}{4}$  h

4.4: 7,5 kg : 500 g

4.5: 30 m : 300 cm

5. Given: ratio 3 : 5.

5.1 What is the smaller amount if the bigger amount is R50?

---

<sup>1</sup>This content is available online at <<http://cnx.org/content/m31192/1.1/>>.

Suggestion:

- Always draw a table.
- In the first column, write: ratio and money.
- Fill in the given data.
- Calculate a.

RATIO	3	5
MONEY (R)	a	50

**Table 3.1**

6. Job opportunities in Langa:

Draw a table and calculate the following:

- How many men are there in Langa if the ratio in numbers between men and women is 3 : 7 , and the number of women is 2 520?

RATIO		

**Table 3.2**

7. At present, education policy in South Africa requires the following in schools: one educator for every 35 learners.

7.1 How many educators may be appointed at the Morningstar Primary School if 315 learners have been enrolled?

7.2 What must the number of learners be if the school has 23 educators?

8. The Education Department attempts to ensure a proportional ratio between educators and learners in all schools:

8.1 How many teachers are in excess and are therefore paid by the school's management council if a particular school has 700 learners and 32 educators?

8.2 What does it cost the parents to pay the salaries of the extra teachers if a teacher earns R4 982,55 per month?

ACTIVITY 2

### 3.1.7.4 Using ratios for easy comparison of particular data and for the division of any unit

#### 3.1.7.5 [LO 1.4, 1.5, 3.7, 4.1]

##### a) Comparing data by making use of ratios

1. Building costs of low cost housing developments in the Western Cape increased from R1 000 to R1 220 /m<sup>2</sup> between 2000 and 2003 as opposed to an increase from R1 330 to R2 102/m<sup>2</sup>, in Gauteng.

1.1 How would you indicate that the increase is fair?

1.1.1 Express all the data as ratios.

	2000	2003
GAUTENG:		
WESTERN CAPE:		



**Table 3.3**

1.1.2 Express each ratio as a decimal number or a percentage. (Make use of your calculator.)

Gauteng:

Western Cape:

1.1.3 Which ratio is larger?

1.1.4 Is the increase fair?

1.1.5 To what would you ascribe the difference?

**b) Division by making use of ratios**

1. Mr Verkuil of the Langverwacht Primary School won R 150 500 in the Lotto last Saturday. He set aside R50 000 for personal use and decided to divide the rest of the money between the school's Aids project and the Helpmekaar Fund for needy farm workers.

He decided to divide the money to the ration of 3 : 5. How much money will each fund obtain?

This is how it can be determined:

1.1 The ratio between the Aids Project (AP) and the Helpmekaar Fund (HMF) is 3 : 5.

What does this mean?

The AP will receive R3 for every R5 that the HMF gets.

- Therefore the first step would be to divide R8.

1.3 So we can do the following:

AP : HMF

3 : 5

The AP portion:  $\frac{3}{8}$  to R = .....

The HMF portion of:  $\frac{5}{8}$  to R ..... = .....

(Use your calculator and round off to the nearest cent where necessary.)

Now try it yourself:

1. Compare each of the following ratios and indicate which one is bigger. Make use of percentages.

1.1 In Zimbabwe, the area of land available to black people as opposed to whites is 1 200 km<sup>2</sup> : 1,35 km<sup>2</sup>.

In South Africa the ratio of land available to black people to white people is 0,95 km<sup>2</sup> : 135 km<sup>2</sup>.

What is the difference in land ownership between Zimbabwe and S.A. expressed as a percentage?

1.2 38 : 73 and 13 : 43

2. During 2003, the Mathematics HG paper indicated a grand total of 400 marks. A mistake crept in and the paper actually counted out of 375 marks.

2.1 Express the above information as a ratio in its simplest form.

2.2 Use the information in 2.1 to convert the marks of the following learners at the Primrose Private School from a mark out of 375 to a mark out of 400:

a) Sarie Neetling: 215

b) Thabo Nakane: 172

c) Maria Schmidt: 370

2.3 Calculate the average of the marks obtained for the Mathematics HG paper at this school:

### 3.1.7.6

### 3.1.7.7 ACTIVITY 3

### 3.1.7.8 Increasing or decreasing a given ratio

### 3.1.7.9 [LO 3.7, 4.1]

In the following activity, and in those that follow, the "recipe" that is given is of utmost importance.

- Recipe for success:

- Always set up a table.
- Always ask: Will the answer be more or less than what is given?

1. Increase R250 by the ratio of 2 : 3.

- Set up a table.
- Question: Where do I put down the R250? Yes, below the ratio of (2), because the amount must be increased to 3. Will the entry below ratio (3) be more or less than R250? Yes, more.
- Now present your information as ratios and calculate the required answer.

Table:

RATIO	2	3
AMOUNT	250	a

**Table 3.4**

- Present your information as ratios:  $2 : 3 = 250 : a$
- 2 and R250 must be in the first positions.  $\frac{2}{3} = \frac{250}{a}$
- (Do crosswise multiplication ):  $2 \times a = 3 \times 250$
- $2a = 750$
- $a = 375$
- Check your calculation: Your answer should be more than R250.

2. Now do the following. Remember the recipe for success:

2.1 Ms Radetski is experiencing financial problems and she decides to ask her domestic helper who has been working 5 days per week to only come to work 2 days per week.

She decides to decrease her domestic worker's present salary of R1 250 per month to the ratio of 5 : 2. Calculate the domestic worker's adjusted salary.

Table:

RATIO		
AMOUNT		

**Table 3.5**

The price of a WV Polo is increased in the ratio of 3 : 5 for 2004. What will the price be in 2004 if the price in 2003 is R117 800?

Table:

RATIO		
AMOUNT		

**Table 3.6**

**3.1.7.10 ACTIVITY 4****3.1.7.11 Comparing two different amounts****3.1.7.12 [LO 3.7, 4.1]**

1. A well-known example is: 120 km/h.

- What is the meaning of it?

2. You drive a distance of 120 km in 2 h. What is your average speed? (km/h means km per hour or  $\text{km} \div \text{h}$ .)

3. When two different units are compared, in this instance km and hours (h), the answer is given as SPEED (km/h) or RATE.

RATE is always indicated as ..... / (per) .....

4. Try to do the following:

4.1 The Kotzes' telephone account for July came to R 180,88 for 234 units.

a) Calculate the cost per unit.

a) What would the account have been if the Kotzes had used 423 units?

4.2 My car used 45,6 litres of fuel over a distance of 730 km and my sister's car used 48,4 litres over a distance of 662,4 km. Which car uses fuel more economically?

4.3 Pick 'n Pay sells Omo washing powder in boxes of two different sizes: 1,5 kg for R25,56 and a 2 kg box for R32,44. Which one is the better buy?

**3.1.7.13 ACTIVITY 5****3.1.7.14 Differentiating between a direct proportion and an indirect proportion****3.1.7.15 [LO 1.5, 3.7, 4.1]**

The recipe for success is also important in this exercise.

- Set up a table.
- The question is: More-more or less-less? The answer is obtained from your table.

(A): Direct proportion: More-more or less-less as the answer to the question.

[DIVIDE]

(B): Indirect Proportion: More-less or less -more as answer to the question.

[MULTIPLY]

(A): E.g.: 6 chocolate bars cost R55,45. How much will 13 bars cost?

Table:

CHOCOLATE BARS	6	13
COSTS	30	a

**Table 3.7**

Your question: Will 13 chocolate bars cost more or less than R30,00?

Your answer : More.

Therefore: 6  $\rightarrow$  to R30  $\rightarrow$  MORE

13  $\rightarrow$  to R a  $\rightarrow$  MORE

This therefore is direct proportion. “DIVISION”

Solution:  $\frac{6}{30} = \frac{13}{a}$  (crosswise multiplication)

$$6a = 13 \times 30$$

$$6a = 390$$

$$a = 65$$

Therefore: 13 chocolate bars cost R65.

(B): 6 men complete a task in 12h. How long will it take 8 men to do the same task?

Table:

MEN	6	8
TIME (H)	12	a

**Table 3.8**

Your question: Will 8 men need more or less time to complete the task?

Your answer: Less.

Therefore: 6  $\rightarrow$  to 12 h  $\rightarrow$  MORE

8  $\rightarrow$  to a h  $\rightarrow$  LESS

This is an indirect proportion. “MULTIPLY”

Solution:  $6 \times 12 = 8 \times a$

$$72 = 8a$$

$$9 = a$$

- Now do the following. Indicate whether there is a direct or indirect proportion. The steps are given with no. 1, but you will have to do the rest yourself.

1. 2 dozen eggs cost R25,50. What do 7 eggs cost?

Table:


**Table 3.9**

Your question:

Your answer:

Therefore:  $\rightarrow$  to  $\rightarrow$  (more/less)

$\rightarrow$  to  $\rightarrow$  (more/less)

This therefore is “ ”

Solution:

2. A 3,5 m-long stick casts a shadow that measures 5,20 m on the ground What is the height of a flagpole that casts a 29,20 m-long shadow?

3. François of 7th Avenue walks at a speed of 5 km/h and cycles at 15 km/h. If he cycles, he reaches the Coffee Den in 15 minutes. How long does he take when he walks?

4. The woodwork educator can cut 12 mm-long strips of wood of length 190 mm from a single length of wood. How many 250 mm-strips could he cut from the same length of wood?

5. A Boeing 747 of the SAA flies from the Cape Town International Airport to London in 17 hours, at an average speed of 1 200 km/h. What will the average speed be if the time is reduced to 13 hours?

### 3.1.8 Assessment

LO 3
Space and Form (geometry)The learner is able to describe and represent features of and relationships between two-dimensional forms and three-dimensional objects in a variety of orientations and positions.
We know this when the learner:
3.2 describes and classifies geometric figures and three-dimensional objects in terms of properties in contexts inclusive of those that can be used to promote awareness of social, cultural and environmental issues, including;3.2.1 sides, angles and diagonals and their relationships, focusing on triangles and quadrilaterals (e.g. types of triangles and quadrilaterals);
3.3 uses vocabulary to describe parallel lines that are cut by a transverse, perpendicular or intersection line, as well as triangles, with reference to angular relationships (e.g. vertically opposite, corresponding);3.4 uses a pair of compasses, a ruler and a protractor for accurately constructing geometric figures so that specific properties may be investigated and nets may be designed;3.5 designs and uses nets to make models of geometric three- dimensional objects that have been studied in the preceding grades and up till now;3.7 uses proportion to describe the effect of expansion and reduction on the properties of geometric figures;3.8 draws and interprets sketches of geometric three-dimensional objects from several perspectives, focusing on the retention of properties.
LO 4
MeasuringThe learner is able to use appropriate measuring units, instruments and formulas in a variety of contexts.
We know this when the learner:
4.1 solves more complicated problems involving time, inclusive of the ratio between time, distance and speed;4.2 solves problems involving the following:4.2.1 length;4.2.2 circumference and area of polygons and circles;4.2.3 volume and exterior area of rectangular prisms and cylinders;
4.3 solves problems using a variety of strategies, including:4.3.1 estimation;4.3.2 calculation to at least two decimal points;4.3.3 use and converting between appropriate S.I. units;
4.5 calculates the following with the use of appropriate formulas:4.5.1 circumference of polygons and circles;4.5.2 area of triangles, right angles and polygons by means of splitting up to triangles and right angles;4.5.3 volume of prisms with triangular and rectangular bases and cylinders;
4.7 estimates, compares, measures and draws triangles accurately to within one degree.

Table 3.10

### 3.1.9 Memorandum

#### ACTIVITY 1

- :3:4:5
  - $\frac{7}{2} : \frac{9}{2} = 7:9$
  - :70:75 = 14:15
  - :7 500:500 = 15:1
  - :3 000:300 = 10:1
6.  $3:7 = x:2\ 520 = \frac{3}{7} = \frac{x}{2\ 520}$   
 $7x = 3 \times 2\ 520$   
 $x = \frac{3 \times 2\ 520}{7}$   
 $= 1\ 080$
- :1:35

$$315 \text{ [U+FOB8] } 35 = 9$$

- $23 \times 35 = 805$
- $32 - (700 \text{ [U+FOB8] } 35) = 12$
- $12 \times R4\,982,55 = R59\,790,60$

## ACTIVITY 2

a)

1.1.1 **2000 2003****Gauteng:** 1 330 2 102**Western Cape:** 1 000 1 220

- Gauteng:  $\frac{1330}{2102} = 0,63 / 63,3\%$

$$\text{Western Cape: } 1000:1220 = \frac{1000}{1220} = 0,82 / 81,97\% = 82\%$$

- Western Cape
- Own conclusion
- Own conclusion

b)

$$1.3 \text{ VP part of } \frac{3}{8} \text{ of R100 500,00} = R37\,687,50$$

$$\text{HMF part of } \frac{5}{8} \text{ of R100 500} = R62\,812,50$$

Now you can try:

$$1.1 \text{ Zimbabwe: } \frac{1200}{1,35} = 888,90$$

$$\text{South Africa: } \frac{0,95}{1,35} = 128,30$$

$$1.2 \frac{38}{73} \times \frac{100}{1} = 52,1\% / \frac{13}{43} \times \frac{100}{1} = 30,2\%$$

- $375:400 = \frac{375}{400} = \frac{15}{16} = 15:16$
- a)  $215 \text{ [U+FOB8] } 15 \times 16 = 229$

$$\text{a) } 172 \text{ [U+FOB8] } 15 \times 16 = 183$$

$$\text{b) } 370 \text{ [U+FOB8] } 15 \times 16 = 395$$

## ACTIVITY 3

2.1 Ratio 5 (less than) 2

Amount 1 250 (less than) x

$$5:2 = 1\,250:x$$

$$\frac{5}{2} = \frac{1250}{x}$$

$$5x = 2500$$

$$x = R500.00$$

## ACTIVITY 4

- Drives 120 km in 1 hour
- $\frac{120}{2} = 60 \text{ km/h}$

$$4.1 \text{ a) } 180,88 \text{ [U+FOB8] } 234 = R0,77/\text{unit}$$

$$\text{a) } 423 \times 0,77 = R325,71$$

- $45,6 \ell = 730 \text{ km} = 16 \text{ km}/\ell$

Sister:  $48,4\ell = 662,4 \text{ km} = 13,69 \text{ km}/\ell$

- A:  $25,56 \text{ [U+F0B8]} 1,5 = \text{R}17,04/ \text{ kg}$

B:  $32,44 \text{ [U+F0B8]} 2 = \text{R}16,22/ \text{ kg} = \text{Best buy}$

#### ACTIVITY 5

1. Table:

dozens (number) 2(24) (less) 7

Price 25,50 (less) x

Therefore: **24** to **7** = **less**

**25,50** to **7,44** = **less**

It is therefore an indirect

Solution:

$$24:7 = 25.50:x$$

$$\frac{24}{7} = \frac{25.50}{x}$$

$$24x = 178,50$$

$$x = \text{R}7,44$$

2. Length 3,5 m (more) x

Shadow 5.20 m (more) 29,20 m

$$3,5: x = 5,2:29,2$$

$$\frac{3.5}{x} = \frac{5.2}{29.2}$$

$$5,2x = 102,2$$

$$x = 19,7 \text{ m}$$

3. Walk 5 km/h (more) 15 km/h

$$\text{Cycle } x \text{ (less)} \frac{15}{60} = \frac{3}{12} = \frac{1}{4} \text{ h}$$

$$5x = 15 \times \frac{1}{4}$$

$$x = 0,75 \text{ h} = \frac{3}{4} \text{ h}$$

4. Pieces 1 2 (less) x

mm 190 (more) 250

$$12 \times 190 = 250x$$

$$9.12 = x$$

9 pieces

5. Time 17 (less) 13

Speed 1200 (more) x

$$17 \times 1200 = 13x$$

$$1569 \text{ km/h} = x$$

## 3.2 The volume and exterior surface of prisms<sup>2</sup>

### 3.2.1 MATHEMATICS

#### 3.2.2 Grade 8

#### 3.2.3 RATIO AND PROPORTION

#### 3.2.4 MEASUREMENT

#### 3.2.5 CONSTRUCTIONS

#### 3.2.6 Module 16

### 3.2.7 THE VOLUME AND EXTERIOR SURFACE AREA OF PRISMS

#### ACTIVITY 1

Discovering the volume and exterior surface area of prisms and formulating a formula for calculating this, and applying the discovered formulas in practical situations

[LO 3.8, 4.2, 4.3, 4.5]

- Information that could be useful while executing this investigation should be noted down here. Your educator will assist you to ensure that the information is correct before you commence the investigation.
1. Write the formulas for calculating the area and volume of each of the following figures:
    - 1.1 Area of a square:
    - 1.2 Area of a rectangle:
    - 1.3 Area of a triangle:
    - 1.4 Area of a circle:
    - 1.5 Volume of a rectangular prism:
    - 1.6 Volume of a cylinder:
  2. Explain what you understand the following to be and sketch it.
    - 2.1 rectangular prism:  
Sketch:
    - 2.2 triangular prism:  
Sketch:
    - 2.3 cube:  
Sketch:
    - 2.4 cylinder:  
Sketch:
  3. What do you understand by the word “volume”?
  4. Name the standard unit of measurement for each of the following:
    - volume:
    - water in a dam, cool drink in bottle:
  5. Study the following representations of nets.
    - 5.1 Rectangular prism:

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<sup>2</sup>This content is available online at <<http://cnx.org/content/m31189/1.1/>>.



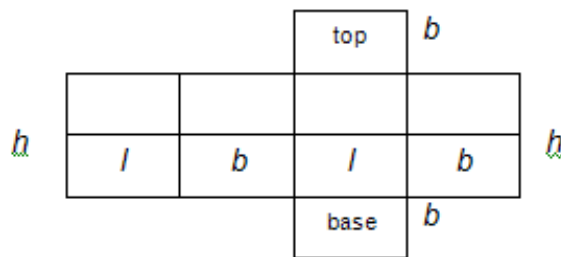


Figure 3.1

5.2 Triangular prism (this is not a proper pyramid):

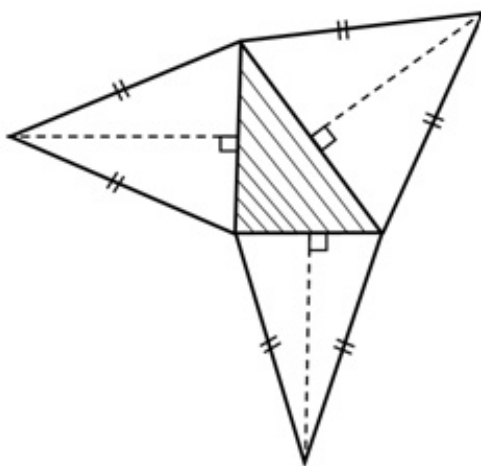


Figure 3.2

### HOMEWORK ASSIGNMENT

Date of submission:

1. Collect the following sweet containers: a rectangular prism, a triangular prism, a cube and a cylinder. Unfold each example so that the complete area is visible and paste each onto a separate sheet of cardboard.
2. Draw a net to represent each of the figures. Indicate the lengths of the sides.
3. Make use of your existing knowledge and determine the total surface area and volume of each example.
4. Work out a formula for calculating the total surface area and the volume of each figure. You may refer to sources for help.

1. Collect other prisms found in everyday situations and calculate the total surface area. (One example will do)

### ASSESSMENT RUBRIC: INVESTIGATION

<b>Criterion 1:</b>	The net is constructed accurately. (CONSTRUCTION)
<b>Criterion 2:</b>	The surface areas and volumes are calculated correctly. (CALCULATIONS)
<b>Criterion 3:</b>	The deduction of formulas for surface areas and volumes is correct. (FORMULAS)
<b>Criterion 4:</b>	The application in practical situations is correct. (REPORT)

Table 3.11

CRITERION	NOT ACHIEVED	AVERAGE ACHIEVEMENT	ACHIEVED	EXCEPTIONAL	MARKS
Construction	The nets are not well constructed.	The nets are constructed relatively well.	The nets are constructed well.	The nets are constructed to meet the requirements for a perfect net.	/20
Calculations	The calculations are incorrect.	The calculations are partially correct.	The calculations are (70 – 90%) correct.	The calculations are (100%) correct.	/10
Formulas	The formulas are not correct or mathematical.	The formulas are partially correct and mathematical.	The formulas are 99% correct.	The formulas are 100% correctly presented.	/10
Report	The report is untidy. The applications (use of mathematics) is weak.	The report is fairly good, but the application is not altogether correct in every instance.	The report is well-presented and the application is correct.	The manner of presentation reveals that extra effort has gone into the exercise.	/10
				TOTAL	/50

Table 3.12

### 3.2.8 Assessment

LO 3
Space and Form (geometry)The learner is able to describe and represent features of and relationships between two-dimensional forms and three-dimensional objects in a variety of orientations and positions.
<i>continued on next page</i>

We know this when the learner:
3.2 describes and classifies geometric figures and three-dimensional objects in terms of properties in contexts inclusive of those that can be used to promote awareness of social, cultural and environmental issues, including;3.2.1 sides, angles and diagonals and their relationships, focusing on triangles and quadrilaterals (e.g. types of triangles and quadrilaterals);
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4.5 calculates the following with the use of appropriate formulas;4.5.1 circumference of polygons and circles;4.5.2 area of triangles, right angles and polygons by means of splitting up to triangles and right angles;4.5.3 volume of prisms with triangular and rectangular bases and cylinders;
4.7 estimates, compares, measures and draws triangles accurately to within one degree.

Table 3.13

### 3.2.9

### 3.2.10 Memorandum

#### ACTIVITY 1

- $\ell^2$
- $\ell \times b$
- $\frac{1}{2} \times b \times h$
- $\pi r^2$
- $\ell \times b \times h$
- $\pi r^2 h$

#### 2. Learners supply.

##### 3. Contents

- $\ell$  /  $\text{m}\ell$  /  $\text{k}\ell$  /  $\text{cm}^3$  /  $\text{mm}^3$  etc.
- $\text{k}\ell$  /  $\ell$  /  $\text{m}\ell$

### 3.3 Construct different types of triangles<sup>3</sup>

#### 3.3.1 MATHEMATICS

#### 3.3.2 Grade 8

#### 3.3.3 RATIO AND PROPORTION

#### 3.3.4 MEASUREMENT

#### 3.3.5 CONSTRUCTIONS

#### 3.3.6 Module 17

#### 3.3.7 CONSTRUCTING DIFFERENT ANGLES AND TRIANGLES

##### 3.3.7.1 ACTIVITY 1

##### 3.3.7.2 Constructing different angles and triangles

##### 3.3.7.3 [LO 3.4, 3.5, 4.7]

1. Drawing an angle: Requirements: pencil, ruler, protractor.

1.1 Always begin by drawing a base line.

1.2 Make a mark, e.g. on the left, and position the protractor on the mark.

1.3 Read your protractor from  $0^\circ$ .

1.4 In the case of an angle that is larger than  $180^\circ$ , the relevant angle size must be deducted from  $360^\circ$  before it is drawn. The angle around the outside (the reflex angle) is the angle that you will have to draw.

E.g.  $320^\circ$ : ( $360^\circ - 320^\circ = 40^\circ$ ). Draw a  $40^\circ$  angle. The reflex angle now represents the  $320^\circ$ .

2. Construct the following angles and name each one:

- $\angle ABC = 75^\circ$

**Type of angle:**

2.2  $\angle CDE = 135^\circ$

**Type of angle:**

2.3  $\angle FGH = 215^\circ$

**Type of angle:**

3. Constructing a triangle:

Requirements: pencil, ruler, protractor and pair of compasses.

- Always begin by making a rough sketch.
- Then use one of the sides of which the length is provided as a base.
- E.g. construct  $\triangle ABC$  with  $BC = 40$  mm,  $\angle B = 70^\circ$  and  $\angle C = 50^\circ$ .

Rough sketch:

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<sup>3</sup>This content is available online at <http://cnx.org/content/m31198/1.1/>.

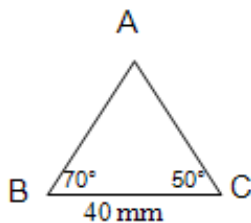


Figure 3.3

- 
- To measure a lateral length accurately, you must measure the length on your ruler with the help of a pair of compasses. Then the compass point must be positioned on B and the position of C must be indicated with a pencil mark.
  - Construction:
4. Construct each of the following triangles:
- 4.2  $\triangle PQR$  with  $QR = 58\text{ mm}$ ,  $\angle Q = 62^\circ$  and  $\angle P = 69^\circ$ .  
Measure:
- a)  $PQ = \text{mm}$   
b)  $\angle R =$
- 4.2 Isosceles  $\triangle ABC$  with  $BC = 42\text{ mm}$ ,  $AB = AC$  and  $\angle B = 63^\circ$ .  
Measure:
- a)  $PQ = \text{mm}$

**3.3.7.4 ACTIVITY 2****3.3.7.5 Bisecting any given line or angle****3.3.7.6 [LO 3.4, 3.5, 4.7]**

1. Bisecting a given line AB:

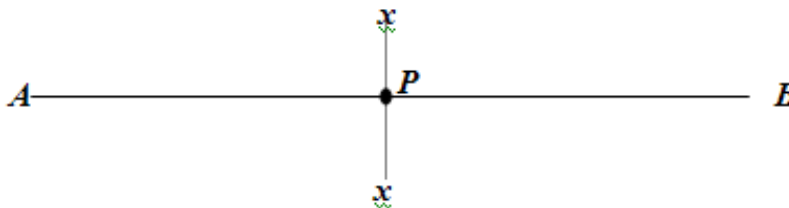
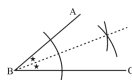


Figure 3.4

- Measuring line segment  $AB$  (e.g. 40 mm).
- Using a pair of compasses, measure slightly more than half of the line (i.e.  $\pm 22-25$  mm).
- Position the point of the pair of compasses on  $A$  and make a pencil stroke below and above the line.
- Position the point of the compasses on  $B$  and draw another pencil stroke above and below the line.
- Connect the intersections of the pencil strokes.
- Name the point on line  $AB$ ,  $P$ .  $P$  is the centre of line  $AB$ .

2. Now try the following:

- Draw line segment  $PQ = 70$  mm.
- Bisecting line segment  $PQ$ , as in nr. 1 explained.



**Figure 3.5**

3. Bisect  $\angle ABC$ :

- Place the point of the pair of compasses on  $B$ .
- Draw an arc of any size as indicated.
- Position the point of the compass on the point where the two lines intersect and draw pencil lines inside the angle.
- Position the point of the compass on the other point of intersection and draw a line inside the angle, so that the two lines intersect.
- Connect  $B$  (angle  $B$ ) with the point where your pencil lines intersect.
- $\angle B1$  will have the same size as  $\angle B2$ . Measure both angles. Are they equal?

4. Try the following:

- Draw  $\angle DEF = 125^\circ$ .
- Bisect  $\angle DEF$ .

### 3.3.7.7 ACTIVITY 3

#### 3.3.7.8 To construct a line perpendicular from a given point to another line

#### 3.3.7.9 [LO 3.4, 3.5, 4.7]

1. Construct  $ADBC$ .

- Place your compass point on  $A$  (you want to draw a perpendicular line on  $BC$  from  $A$ .)
- Make an arc on  $BC$ .
- Place the point of your compasses on the one point of intersection between the arc and  $BC$ . Draw a line below  $BC$ . Place the point of your compasses on the other point of intersection between the arc and  $BC$  and draw another line below  $BC$ , so that the two lines intersect.
- Connect  $A$  with the intersection of the two drawn lines.
- Mark the point of intersection  $D$ .

- $AD$  will be perpendicular to  $BC$ . ( $AD \perp BC$ .)

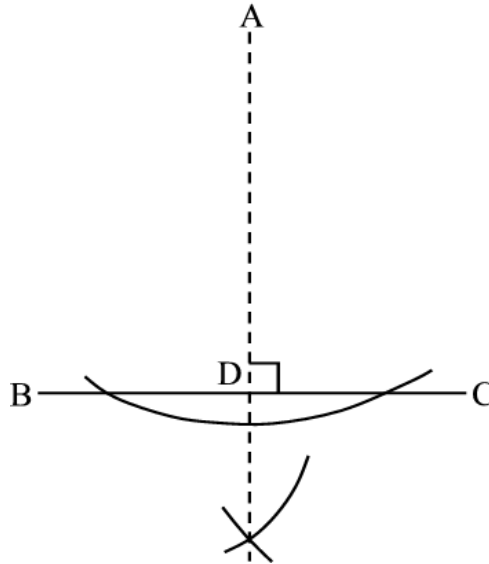


Figure 3.6

2. Try doing the following:

- Draw any acute-angled  $\triangle PQR$ .
- Construct  $PSQR$ .
- What is the meaning of  $PSQR$ ?

#### 3.3.7.10 ACTIVITY 4

#### 3.3.7.11 Constructing inscribed and circumscribed circles

#### 3.3.7.12 [LO 3.4, 3.5, 4.7]

1. Constructing a circumscribed circle:

- Draw any acute-angled triangle.
- Bisect all three angles. You will notice that the three bisecting lines meet in a single point.
- Try to locate the distance where you could position your compass to draw a circle within or around the triangle.
- Explain what the distance was at which you were able to draw an accurate circle around the triangle.
- What is this distance called?
- What type of circle could you draw?

1.7 Conclusion: A circle can be constructed by bisecting the angles of a triangle.

2. Constructing an inscribed circle:

- Draw any acute-angled triangle.
  - Bisect all three angles. You will notice that the three bisecting lines meet in a single point.
  - Try to locate the distance where you could position your compass to draw a circle within or around the triangle.
  - Explain what the distance was at which you were able to draw an accurate circle inside the triangle.
- 
- What is this distance called?
- 
- What type of circle could you draw?

2.7 Conclusion: A circle can be constructed by bisecting the of a triangle.

### 3.3.7.13 ACTIVITY 5

#### 3.3.7.14 Constructing a line parallel (ll) to a requested line with the help of a pair of compasses

#### 3.3.7.15 [LO 3.4, 3.5, 4.7]

- Required: construct  $FA \parallel QR$ , so that  $AR = 30$  mm.
  - 1.1 Draw an imaginary line (dotted line)  $FA$  where the parallel line is required to be.
  - 1.2 Mark  $A$  on  $PR$  so that  $AR = 30$  mm.
  - 1.3 Position the point of your compasses on  $R$  and draw an arc (any size) as indicated.
  - 1.4 Maintaining the setting of your pair of compasses (same size), place the point on  $A$  and draw an arc like the previous one.
  - 1.5 Measure the distance, marking it with crosses (x) as indicated.
  - 1.6 Place the compass point on the circle (o) as indicated. This line will intersect the arc and should be on the imaginary line.
  - 1.7 Connect  $A$  with the intersecting point of the last drawn line.
  - 1.8 Mark  $F$  on  $PQ$ .  $FA$  will be parallel to  $QR$ .
  - 1.9 What does it mean when we say that  $FA \parallel QR$ ?

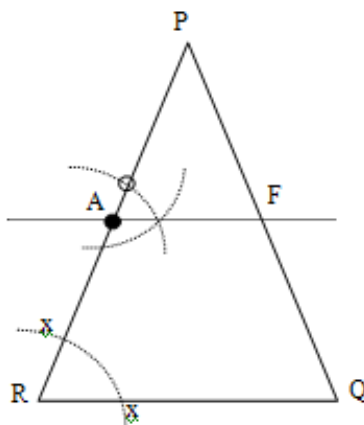


Figure 3.7

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2. Try doing the following by yourself:

- Construct any obtuse-angled  $\triangle PQR$ .
- Bisect  $PR$  and designate the centre  $F$ .
- Draw a line through  $F$  parallel to  $QR$ .
- The parallel line  $PQ$  must intersect  $G$ .

### 3.3.7.16 ACTIVITY 6

#### 3.3.7.17 Constructing a parallelogram

#### 3.3.7.18 [LO 3.4, 3.5, 4.7]

1. You are the owner of a farm in Mpumalanga. You wish to reward one of your farm workers, Michael Mohapi, for his good service of the past 20 years. You present Michael with a stretch of land as a gift. The precondition is that the land must be measured out in the form of a parallelogram according to measurements indicated on a plan.

1.1 The first problem that arises has to do with the fact that Michael does not know what a parallelogram is. Use a sketch to provide Michael with all the characteristics of a parallelogram.

1.2 Also show Michael the mathematical “abbreviation” for a parallelogram, so that he will know what is meant when he sees the relevant “sign”.

1.3 Now you have to execute a construction to indicate exactly how the land is to be measured.

### 3.3.8 Assessment

LO 3
Space and Form (geometry)The learner is able to describe and represent features of and relationships between two-dimensional forms and three-dimensional objects in a variety of orientations and positions.
We know this when the learner:
3.2 describes and classifies geometric figures and three-dimensional objects in terms of properties in contexts inclusive of those that can be used to promote awareness of social, cultural and environmental issues, including;3.2.1 sides, angles and diagonals and their relationships, focusing on triangles and quadrilaterals (e.g. types of triangles and quadrilaterals);
3.3 uses vocabulary to describe parallel lines that are cut by a transverse, perpendicular or intersection line, as well as triangles, with reference to angular relationships (e.g. vertically opposite, corresponding);3.4 uses a pair of compasses, a ruler and a protractor for accurately constructing geometric figures so that specific properties may be investigated and nets may be designed;3.5 designs and uses nets to make models of geometric three- dimensional objects that have been studied in the preceding grades and up till now;3.7 uses proportion to describe the effect of expansion and reduction on the properties of geometric figures;3.8 draws and interprets sketches of geometric three-dimensional objects from several perspectives, focusing on the retention of properties.
<i>continued on next page</i>

LO 4
MeasuringThe learner is able to use appropriate measuring units, instruments and formulas in a variety of contexts.
We know this when the learner:
4.1 solves more complicated problems involving time, inclusive of the ratio between time, distance and speed;4.2 solves problems involving the following:4.2.1 length;4.2.2 circumference and area of polygons and circles;4.2.3 volume and exterior area of rectangular prisms and cylinders;
4.3 solves problems using a variety of strategies, including:4.3.1 estimation;4.3.2 calculation to at least two decimal points;4.3.3 use and converting between appropriate S.I. units;
4.5 calculates the following with the use of appropriate formulas:4.5.1 circumference of polygons and circles;4.5.2 area of triangles, right angles and polygons by means of splitting up to triangles and right angles;4.5.3 volume of prisms with triangular and rectangular bases and cylinders;
4.7 estimates, compares, measures and draws triangles accurately to within one degree.

**Table 3.14**

### 3.3.9 Memorandum

#### ACTIVITY 1 – ACTIVITY 5

The memorandum of this learning unit is done by the learners and /or determined by the teacher for corrections.

#### ACTIVITY 6

1. Both pairs opposite sides are equal.
2. Both pairs opposite sides are parallel.
3. Both pairs opposite angles are equal.
4. Diagonals bisect each other.
5. One pair opposite sides – equal and parallel.

## Chapter 4

(Untitled)

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